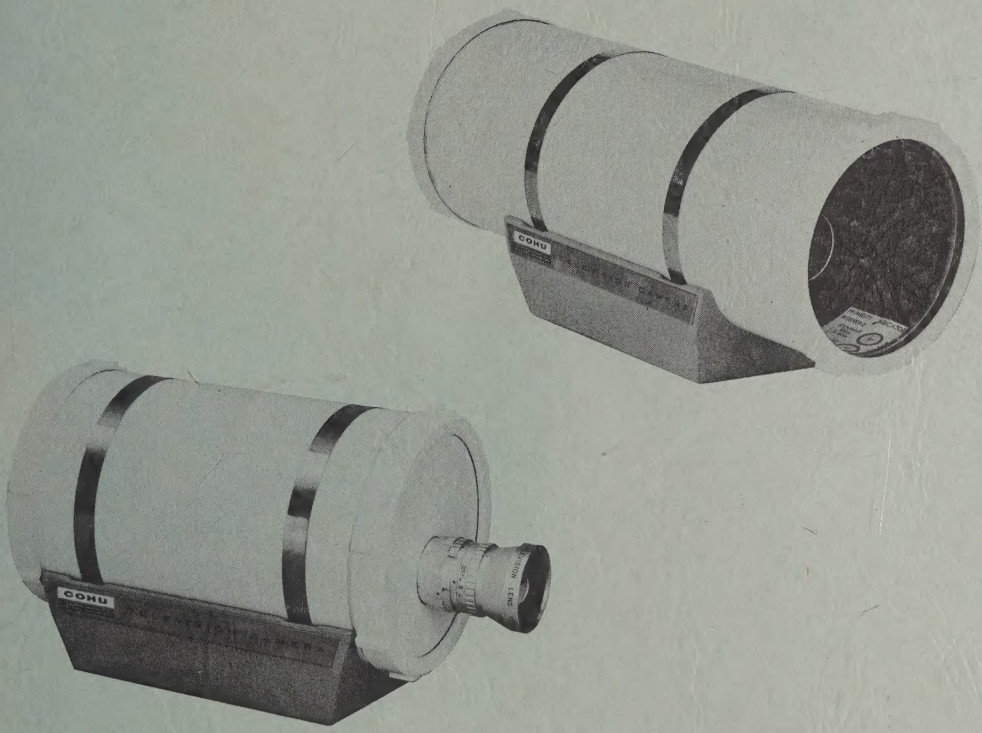
1 OF 2

USB

Technical Manual
Code No. 6X-330

ME-1516



OPERATING AND MAINTENANCE INSTRUCTIONS FOR

HIGH-RESOLUTION ENVIRONMENT-RESISTANT TELEVISION CAMERAS

3000 SERIES

Box 623 / San Diego, California 92112 / Phone (714) 277-6700

COHU ELECTRONICS, INC
SAN DIEGO DIVISION

ME-1516
Technical Manual
Code No. 6X-330

OPERATING AND MAINTENANCE INSTRUCTIONS FOR 3000 SERIES TELEVISION CAMERAS

SERIAL NUMBER EFFECTIVITY

Camera Electrical Assemblies:	2-0001 and ON
10-mc Video Preamplifiers:	3-0001 and ON
20-mc Video Preamplifiers:	4-0001 and ON
Deflection Output Assemblies:	6-0001 and ON

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COHU ELECTRONICS, INC.
Box 623, San Diego, California 92112

10 OCTOBER 1966

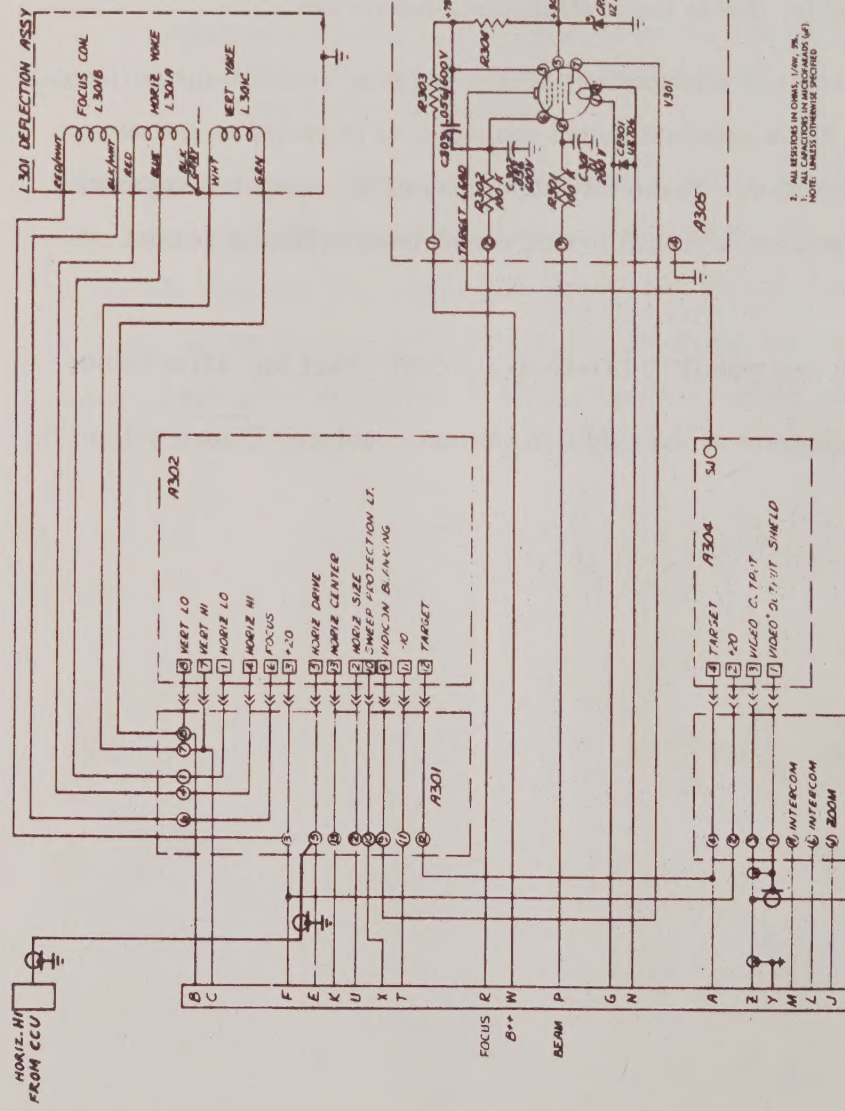

Figure 1. Schematic Diagram, 3000/ER 2576B Camera, Less Preamplifier and Deflection Circuitry (Dwg. No. 577321-112)

Data incorporated in this publication is presented with the assumption that the reader is familiar with the basic theory of closed-circuit television systems employing vidicon pickup tubes, and has a working knowledge of the essentials of television optics.

THE FOLLOWING REFERENCES ARE RECOMMENDED:

Principles of Television Engineering, by D. G. Fink, McGraw-Hill

Transistor Circuit Design, by Texas Instruments, McGraw-Hill

GE Transistor Manual, Semiconductor Products Division, General Electric Co.

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Section I
GENERAL DESCRIPTION

1.1. INTRODUCTION

Instructions and other pertinent data relating to KIN TEL's 3000 series television cameras are presented in this publication for the installation, operation, and maintenance of standard units in the basic series. Those units which incorporate changes to standard circuitry, or which otherwise involve departures from electrical, mechanical, or environmental parameters herein described, will be covered by difference-data sheets attached to this publication.

When reordering instruction manuals for units which incorporate such differences, reference must be made to the serial numbers of camera and plug-in assemblies, code number for this basic manual (6X-330), and to the code numbers of the respective difference-data sheets which apply to the specific system.

1.2. PHYSICAL DETAILS

The electrical assembly of 3000 series cameras is mounted in a sturdy framework; the rear end plate of the framework is equipped with a sealed bulkhead multiconnector for camera cable connections. The assembly is installed in a cylindrical housing, positioned by mating of the rear end plate to the housing interior. A threaded bezel ring is screwed onto the housing, pressing an "O" ring against the end plate to provide a hermetic seal.

The standard housing is machined of corrosion-resistant aluminum alloy and finished with a heat-reflecting weather-resistant baked white enamel. Housing length is determined by lens requirements. Circuitry and optics are totally enclosed and protected within the sealed housing of most 3000 series cameras. In these units, a non-reflecting faceplate of optical glass is bezel-sealed at the front of the enclosure (Figure 1-1). Another configuration (Figure 1-2) provides for mounting of lenses outside the housing. This simplifies changing of lenses or lens adjustments in those installations not requiring protection for the optics.

All cameras of the 3000 series utilize plug-in circuit assemblies, and all circuit components---other than the vidicon tube ---are solid state.

Figure 1-1. Typical Enclosed-Lens Camera of the 3000 Series

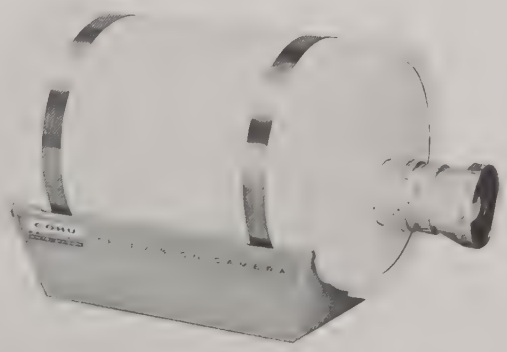


Figure 1-2. Typical Exposed-Lens Camera of the 3000 Series

Outlines and dimensions of standard models are illustrated in Figure 1-3.

1.3. IDENTIFICATION

A wide range of optics may be used with 3000 series cameras. Lenses of fixed focal length and zoom lenses in several ratios of focal-length variation are available. Table 1-1 specifies the identifying structure of 3000 series camera model numbers and tabulates the more commonly used combinations of electrical assembly, lens, barrel (housing), vidicon, and hardware.

1.4. ELECTRICAL CHARACTERISTICS

Circuitry of 3000 series cameras includes a video preamplifier which amplifies vidicon output and matches camera output impedance to that of the associated cable. Deflection circuits provide sawtooth current waveforms furnishing beam deflection for scanning the vidicon target, and a vidicon-protecting circuit averts possible target damage if cable conductor continuity is lost or if the sweep signal fails for any other reason. Another circuit provides a constant current supply for the vidicon focus coil.

Operating voltages are furnished by a 3900 series camera control, which supplies power, deflection and synchronizing waveforms to the camera via a single multiconductor cable. Plug-in circuit construction of both camera and control allows selection of bandwidth and scanning rates which---in conjunction with vidicon selection---permits a choice of horizontal and vertical resolution.

1.5. SPECIFICATIONS

Table 1-2 lists the detailed specifications of standard 3000 series cameras as used with 3900 series camera controls.

Table 1-1. 3000 Series Cameras and Lens Combinations

HOUSING MODEL NUMBER	HOUSING DIMENSION "A"	LENSES ACCOMMODATED (Refer to Data Sheets 6-322 and 6-323 for Lens Specs)	CAMERA (LESS LENS) WEIGHT (LBS) NET	SHIPPED
3000-011	9.98	EXTERNAL MOUNTING OF ALL STANDARD 16 MM "C" MOUNT LENSES, INCLUDING ALL LISTED BELOW	12.4	24.4
3000-012	14.19	ENCLOSED, SEALED MOUNTING OF AL-1, AL-1A, AL-2 AL-2A, AL-15	13.9	25.9
3000-013	15.99	ENCLOSED, SEALED MOUNTING OF AL-4, AL-4A, AL-5A, AL-7, AL-8, 2405	14.5	26.5
3000-014	18.69	ENCLOSED, SEALED MOUNTING OF AL-7A, AL-8A, 2405 WITH 2308 OR 2309 EXTENDER, 2407 WITH OR WITHOUT EITHER EXTENDER	15.5	27.5
3000-015	12.99	ENCLOSED, SEALED MOUNTING OF AL-14	13.5	25.5

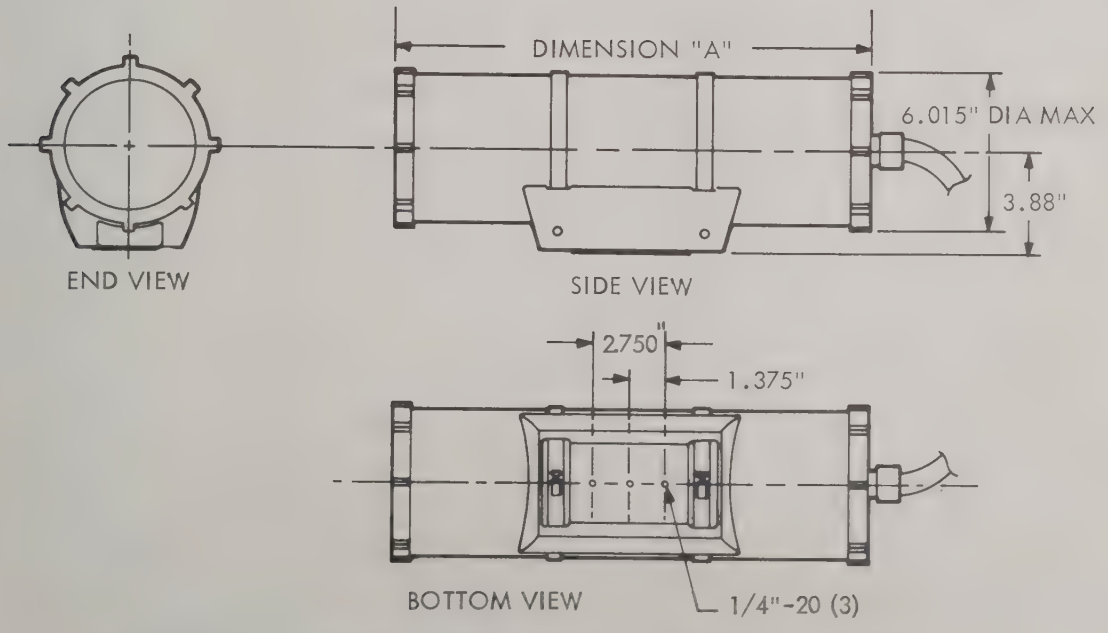


Figure 1-3. Outlines and Dimensions, 3000 Series Cameras

Table 1-2. Specifications, 3000 Series High-Resolution Television Camera

ENVIRONMENTAL

(Environmental tabulations — excepting magnetic shielding — apply only to sealed cameras)

OPERATING TEMPERATURE:
-20°C to +60°C (-4°F to +140°F) without auxiliary heating or cooling

STORAGE TEMPERATURE:
-65°C to +85°C (-85°F to +185°F)

MAGNETIC SHIELDING:
Vidicon assembly shielded by Mu-metal magnetic shield

HUMIDITY:
Up to 100% humidity

ALTITUDE:
Out to deep space

EXPLOSION:
Meets MIL-E-5272C, Procedure IV, Paragraph 4.13.5. and MIL-STD-810, Procedure II, Method 511

UNDERWATER:
250 feet in depth with factory-installed waterproof cable connections; greater depths with moderate changes in faceplate specifications

ELECTRICAL (Measured at 25°C)

OVERALL SYSTEM BANDWIDTH	10 MEGACYCLES		20 MEGACYCLES	
SCANNING PATTERN (FOR ALL SYSTEMS, 2:1 INTERLACE; VERTICAL FIELD FREQUENCY 60 CPS; VERTICAL FRAME FREQUENCY 30 CPS; HORIZONTAL FREQUENCY AS SHOWN)	525-LINE 15,750 CPS	729-LINE 21,870 CPS	873-LINE 26,190 CPS	945-LINE 28,350 CPS
HORIZONTAL RESOLUTION (AT CENTER OF PICTURE) (AT ALL FOUR CORNERS)	800 LINES 650 LINES	550 LINES 450 LINES	850 LINES 650 LINES	800 LINES 650 LINES
VERTICAL RESOLUTION (AT CENTER OF PICTURE)	350 LINES	500 LINES	600 LINES	650 LINES

LINEARITY AND DISTORTION:
Combined geometric distortion and scan non-linearity within 2% (measured in accordance with EIA Specification RS-170)

SENSITIVITY:
Produces usable picture with 0.1 footcandle of illumination on the vidicon face. Meets stated resolution specifications and provides all ten shades of gray on EIA test pattern with linear gray scale with one footcandle highlight illumination on the face of the vidicon

ELECTRICAL FOCUS:
Transistor regulator assures constant current through the magnetic focus coil

VIDICON PROTECTION:
All solid state circuits protect vidicon in event of sweep or cable failure

EMI SUPPRESSION:
Built in filter circuits

POWER REQUIREMENTS:
All supplied through camera cable by camera control

MECHANICAL

CIRCUIT CONSTRUCTION:
All electronic components mounted on plug-in epoxy glass boards

LENS MOUNT:
Standard 16 mm "C" mount

CAMERA HOUSING:
High strength, tubular construction

CAMERA MOUNTING:
Three 1/4"-20 mounting sockets in base on camera. Camera may be rotated on base

CAMERA CABLE:
A selection of camera cable with MIL standard connectors available

CABLE CONNECTION:
Cable connector on camera of MIL standard type; available for all environments. All internal camera accessories energized through camera cable from camera control

ACCESSORY ADAPTABILITY:
Camera accessory installation without camera modification

DIMENSIONS:
See dimensional drawing

WEIGHT:
See Camera Housing Table

COHU reserves the right to change specifications without notice.

Section II
INSTALLATION AND OPERATION

2.1. GENERAL

Information given here applies to all standard cameras of the 3000 series, with differences between internal and external optics as indicated.

2.2. RECEIVING INSPECTION

Immediately upon receipt of equipment, inspection should be performed to reveal any visible or functional damage which may have occurred in shipment. (See Form P-293-5-62-5M enclosed in the packing container.) Operational testing must be performed to ascertain whether concealed functional damage has been incurred in transit.

2.2.1. OPERATIONAL TEST. Operational testing of the camera is performed by connecting the camera to the related camera control, connecting the camera control to the system monitor(s), and operating the complete system.

2.2.2. SYSTEM CONNECTIONS. The camera is connected to the camera control by AC-24 or other specified multiconductor cable fitted with matching connectors. Output to the monitor(s) is via standard coaxial cable fitted with proper connectors.

When a television system has been ordered for operation over specific cable distances, factory adjustments have been set for optimum picture quality with the specified cable length; if the cable length has not been specified, the system is set to operate on a 25-foot length of AC-24 cable. Usually, cable ordered with the system will accompany the system as part of the same shipment. If other than the specified length of cable is used for a performance test, picture quality will be affected.

2.2.3. MONITOR MATCHING. When a camera and control unit are tested with any but the individual monitor(s) intended for a particular installation, be certain that the test monitor is one having sufficient bandwidth and overall resolution to meet the resolution requirements of the system. Recommended monitors for matching specific system parameters are tabulated in the Accessories section of this publication.

2.2.4. TESTING PROCEDURE. To test a connected system, switch on the camera control and monitor and allow circuits to warm. Install lens on camera if not installed. Within two minutes of turn-on, the monitor should display a picture. If no picture appears, adjust operating controls as prescribed in the manual for the 3900 series camera controls. If picture appears to be out of focus, adjust camera lens setting. (Refer to paragraph 2.4.2.)

2.3. INSTALLATION

Installation of standard 3000 series cameras involves only two basic procedures:

a. Attach the camera to the selected mounting (pan and tilt unit, pedestal dolly, tripod, etc.);

b. Connect the camera to the camera control via the specified cable.

2.3.1. MOUNTING. Three threaded holes in the camera base accept standard tripod

screws (1/4"-20). Positioning may be adjusted for best balance, depending upon the weight distribution of the camera (determined by the lens and/or lens accessories in use). Alternatively, the base may be removed for mounting the camera barrel in custom made clamps or other special installation.

2.3.2. CONNECTIONS. Interconnections for components of two of the most commonly used systems are illustrated in Figure 2-1 and Figure 2-2. The system shown in Figure 2-1 is a basic system utilizing no camera accessories. The multiconductor cable---fitted with the specified connectors as shown in Figure 2-3---is used between camera and camera control. Standard coaxial video cable such as RG-59A/U is used between camera control and monitor(s). Spare conductors of the camera cable may be used to carry control currents of some accessories, such as a zoom lens. The system shown in Figure 2-2 illustrates the use of a multiconductor cable (in this case, AC-23) having additional conductors of sufficient size to carry currents of heavier accessories, such as a pan and tilt unit. Additional considerations are discussed in the Accessories section of this manual.

2.4. INITIAL ADJUSTMENTS

Certain system adjustments may require refinement for initial operation after installation, particularly if control adjustments have been changed during receiving inspection. Usually these will concern only adjustments of the system camera control, as outlined in the manual for the 3900 series. Camera adjustments normally will be limited to those involving the optical system.

2.4.1. LENS ACCESSIBILITY. Lens installation or replacement in a 3000 series camera (for internally mounted lenses) requires removal of the camera faceplate. Use the spanner wrench furnished in the camera kit to loosen the front bezel; remove the bezel, gasket, faceplate, "O" ring, and retainer (see Figure 2-4), and place them in a safe area.

If purchased without lens, the camera will be equipped with an escutcheon button (shown in Figure 2-4) to protect the vidicon and the "C" mount adapter threads. Unscrew this disc from the "C" mount adapter. With vidicon thus exposed, avoid direct exposure of the front of the camera to extremely bright lights.

CAUTION

The photosensitive surface of the vidicon target may be severely damaged by exposure to the direct rays of the sun or other source of extremely brilliant illumination. If a camera must be unattended and it is possible that the sun may move into a position allowing direct exposure of the vidicon, or if other inadvertent exposure is likely, it is advisable to install a solar shutter or other automatic device to protect the vidicon. A KIN TEL series DF filter may be used on the lens if an automatic shutter is impractical for a specific installation. The DF filter will reduce lens speed by one f-stop.

For operational tests not requiring optimum focus, the lens focus adjustment may be set at infinity and the lens speed (iris diaphragm opening) at f/3.5. Screw the lens into the "C" mount adapter and replace the front closure components.

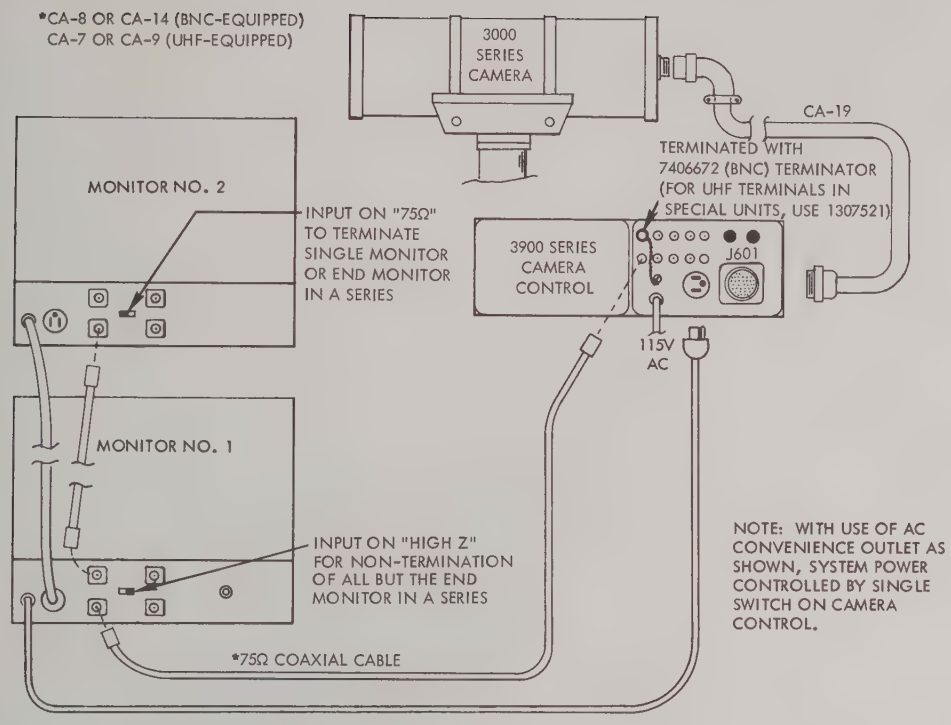

*CA-8 OR CA-14 (BNC-EQUIPPED)
CA-7 OR CA-9 (UHF-EQUIPPED)
3000 SERIES CAMERA
CA-19
TERMINATED WITH 7406672 (BNC) TERMINATOR (FOR UHF TERMINALS IN SPECIAL UNITS, USE 1307521)
MONITOR NO. 2
INPUT ON "75Ω" TO TERMINATE SINGLE MONITOR OR END MONITOR IN A SERIES
3900 SERIES CAMERA CONTROL
J601
115V AC
MONITOR NO. 1
INPUT ON "HIGH Z" FOR NON-TERMINATION OF ALL BUT THE END MONITOR IN A SERIES
NOTE: WITH USE OF AC CONVENIENCE OUTLET AS SHOWN, SYSTEM POWER CONTROLLED BY SINGLE SWITCH ON CAMERA CONTROL.
*75Ω COAXIAL CABLE

Figure 2-1. Typical Television System Utilizing Two Video Monitors

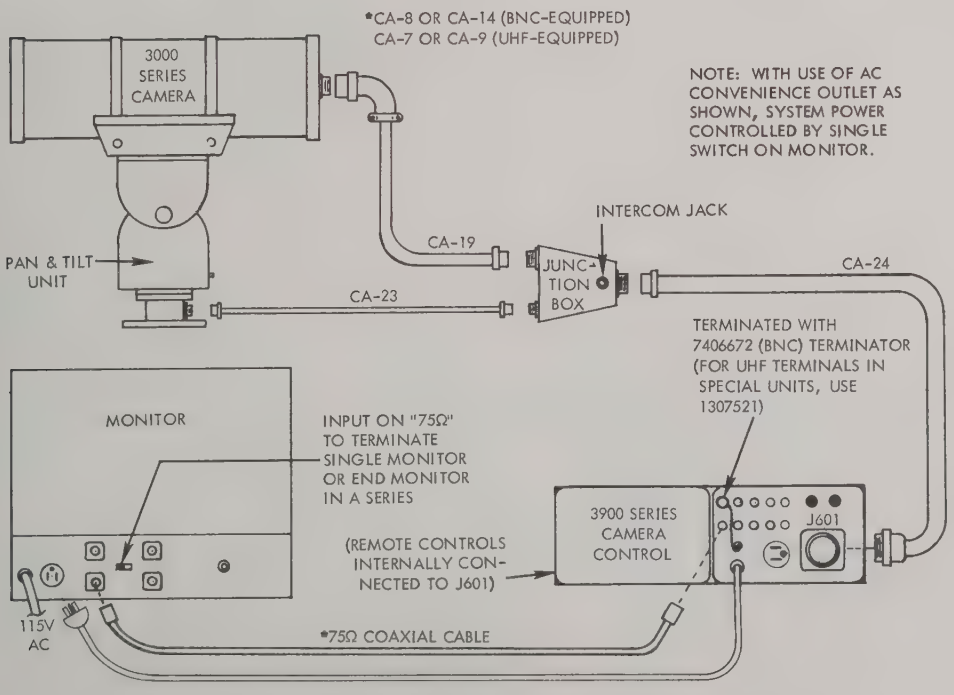
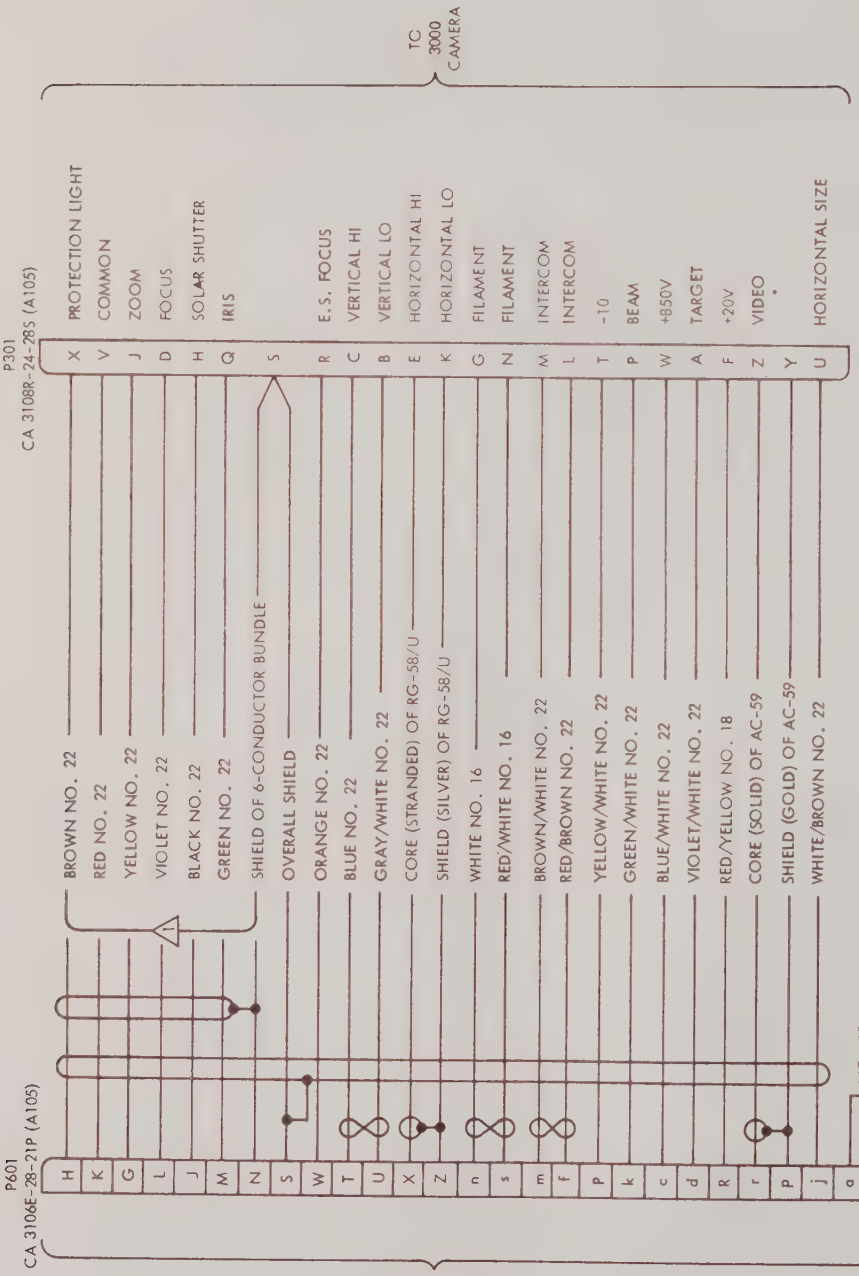

*CA-8 OR CA-14 (BNC-EQUIPPED)
CA-7 OR CA-9 (UHF-EQUIPPED)
3000 SERIES CAMERA
NOTE: WITH USE OF AC CONVENIENCE OUTLET AS SHOWN, SYSTEM POWER CONTROLLED BY SINGLE SWITCH ON MONITOR.
INTERCOM JACK
CA-19
PAN & TILT UNIT
JUNC-TION BOX
CA-24
CA-23
TERMINATED WITH 7406672 (BNC) TERMINATOR (FOR UHF TERMINALS IN SPECIAL UNITS, USE 1307521)
MONITOR
INPUT ON "75Ω" TO TERMINATE SINGLE MONITOR OR END MONITOR IN A SERIES
3900 SERIES CAMERA CONTROL
J601
(REMOTE CONTROLS INTERNALLY CON-NECTED TO J601)
115V AC
*75Ω COAXIAL CABLE

Figure 2-2. Typical Television System Using Accessories which Draw Heavy Currents



4. SHIELDS NOT TO BE CONNECTED TO OTHER SHIELDS OR GROUNDS WITHIN CABLE OR CONNECTOR.
3. 2ND COLOR DENOTES TRACER.
2. FIRST COLOR DENOTES WIRE BODY.
1. 6-CONDUCTOR BUNDLE IN SHIELD.

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 2-3. Schematic Diagram, AC-24 Cable with Connectors for 3000 Series Cameras and 3900 Series Camera Controls

2.4.2. FOCUS ADJUSTMENTS. Proper focus can be obtained only if the lens-to-vidicon distance is correctly adjusted. This distance is set by the positioning of the special "C" mount adapter, which is locked in place by a set screw (see Figure 2-5). The replacement of any individual lens or vidicon may require readjustment of lens-to-vidicon spacing as outlined in the following steps:

a. Remove front closure components as described under 2.4.1. above;

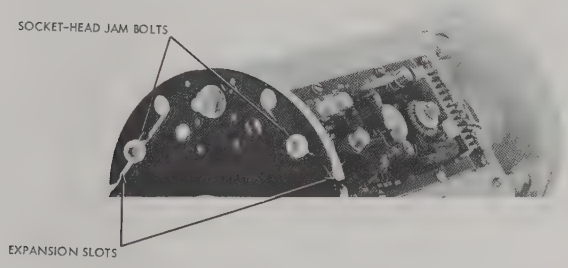


Figure 2-4. Enclosed-Lens Camera, Front Closure Items Removed

b. Loosen the front bezel ring with the spanner wrench; remove the front bezel and gasket;

c. Use the large hex wrench from the camera kit to loosen the socket-head jam-bolts (large set screws) in the front disc of the electrical assembly (shown in Figure 2-4). These must be loosened just sufficiently to release the pressure of the disc edges against the housing interior;

d. Grasp the cable connector and withdraw the assembly from the housing (better grip may be obtained by attaching the cable to the camera for this operation);

e. (If vidicon is to be replaced) proceed according to instructions under VIDICON REPLACEMENT in the Maintenance section of this manual;

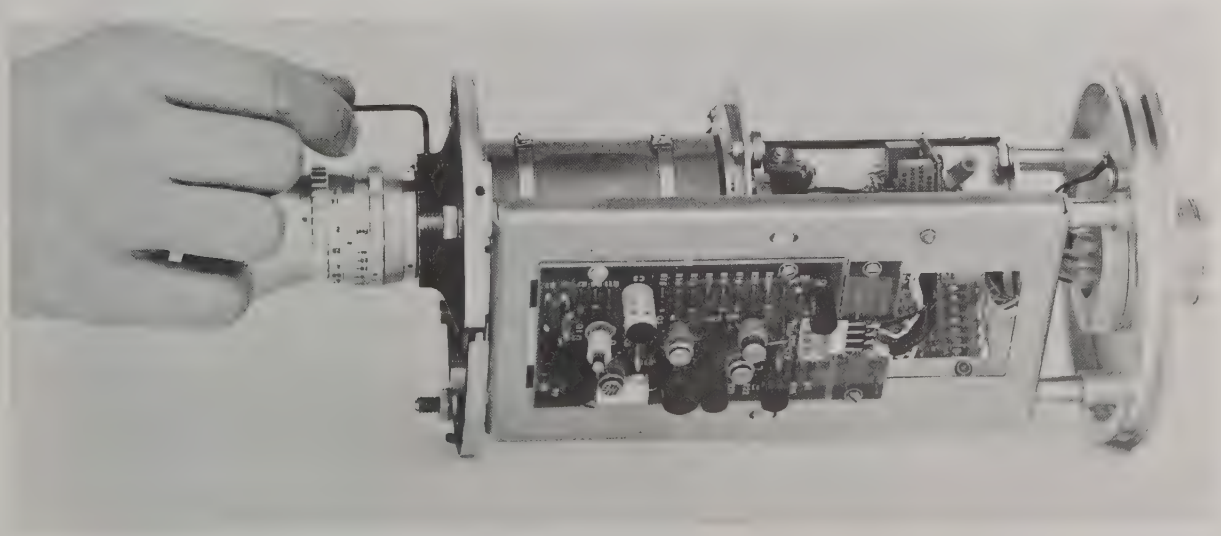


Figure 2-5. Adjustment of "C" Mount Adapter Set Screw

f. The assembly should be mounted on a Cohu/Kin Tel Camera Test Jig with Linearity and Resolution Patterns. If this unit---highly recommended for precision testing of the camera---is not used, the camera may be fastened to a solid work surface for testing. (Tape the assembly to a flat board, or otherwise prevent its movement during test procedures.)

g. Loosen the "C" mount adapter set screw with the small hex wrench as shown in Figure 2-5. Remove adapter with special spanner as shown in Figure 2-6. Attach the lens to the adapter ---finger-tight only;

h. If camera test jig is in use, the glass test pattern designed for the jig should be lighted. (See Figure 2-7.) Alternatively, aim the camera at a suitably detailed subject---a test pattern or piece of printed matter taped to a wall or other plane surface perpendicular to the camera---from a distance exactly equal to the minimum distance setting of the lens used;

i. Switch on the system. While circuits are warming, set the lens for minimum distance---p r e c i s e l y on the setting mark---and open the lens iris fully (to the smallest f-stop number);

j. Screw the "C" mount adapter-and-lens into the lens well of the front camera disc, taking care to avoid disturbing the settings. Adjust position of the lens-and-adapter assembly to obtain the sharpest focus of the picture viewed on the monitor;

k. When optimum focus is obtained, hold the adapter securely in place and retighten the set screw with the small hex wrench;

l. Set the lens focus for the camera-to-subject distance of the permanent installation, and set the iris f-stop for the expected or precalculated light values of the installation;

m. Remove and replace the dessicant package if necessary (refer to DESSICANT REPLACEMENT in the Maintenance section of this manual);

n. Replace electrical assembly in housing, watching monitor while rotating the assembly within the housing to eliminate picture tilt on the screen;

o. Hold the assembly in position and replace the rear gasket and bezel; tighten the bezel as tightly as possible without moving the assembly within the housing; tighten the jam bolts in the front disc to seat them against the housing interior; complete tightening of the bezel;

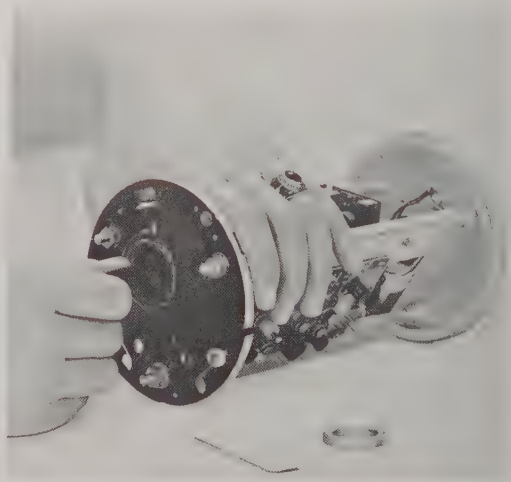


Figure 2-6. Use of Special Spanner to Remove Lens Well Components

p. Replace the front closure components and tighten the front bezel in place.

2.5. OPERATION

Because operating controls for a 3000 series camera are located in the associated camera control, operating instructions---other than those given in the preceding paragraphs---are presented in the manual for 3900 series camera controls.

2.6. ACCESSORIES

Standard and special accessories currently available for 3000 series cameras include a selection of vidicon tubes; a complete complement of lenses; tripods, pedestal dollies, and other mountings; and various units providing remote control of specific camera or accessory functions. Instructions for these are presented in the manuals for the respective accessories. Certain accessories are described in section V of this manual.

2.7. WARRANTY

Standard warranty certificate, Form No. S-212 (an integral part of this manual), applies to 3000 series cameras and associated equipment. Instructions and conditions stated or implied in this manual are not to be interpreted in any manner which would conflict with or modify the meaning or intent of the enclosed warranty.

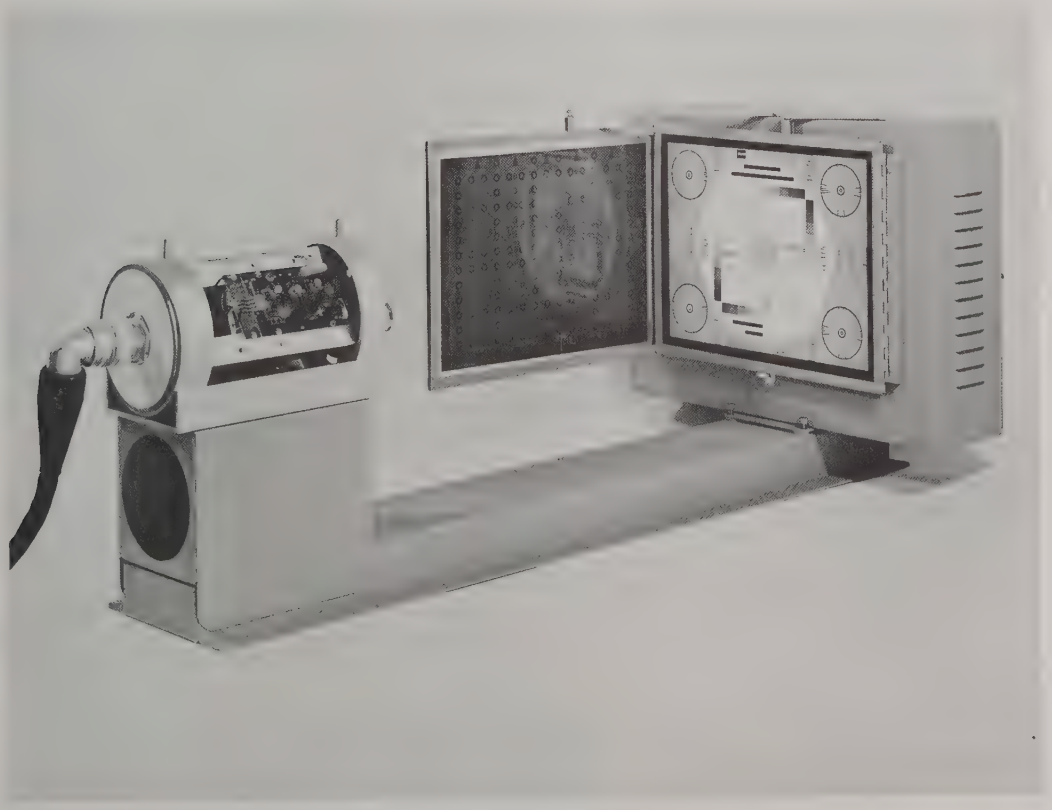


Figure 2-7. Camera on Test Jig With Resolution Test Pattern

Section III
THEORY OF OPERATION

3.1. CIRCUIT IDENTIFICATION

Circuitry of the basic 3000 series camera consists of (1) a vidicon photoconductive tube which converts visual information from light patterns into electronic signals; (2) a deflection-and-focus-coil assembly which serves as a mounting for the vidicon and---in response to applied currents---deflects the vidicon electron beam scanning the vidicon target in a preset pattern and magnetically focuses the beam on the target; (3) a plug-in deflection circuit assembly which receives pulses and power from the camera control and provides the proper currents to the deflection coils, vidicon blanking, and a constant current source for the focus coil; (4) a plug-in video preamplifier circuit assembly which amplifies the vidicon output to drive coaxial output; and (5) a filter circuit assembly installed on the vidicon socket.

Figure 3-1 illustrates circuit relationships within a typical system utilizing the 3000 series camera. Figure 3-2 shows the functions of the circuits within the basic 3000 series camera.

3.2. VIDEO PREAMPLIFIERS

Circuitry of the video preamplifier is designed in two basic configurations. One of these provides a bandwidth of 10 megacycles; the other is of 20-megacycle bandwidth. Choice of video preamplifier bandwidth and other options presents a selection of horizontal and vertical resolution combinations.

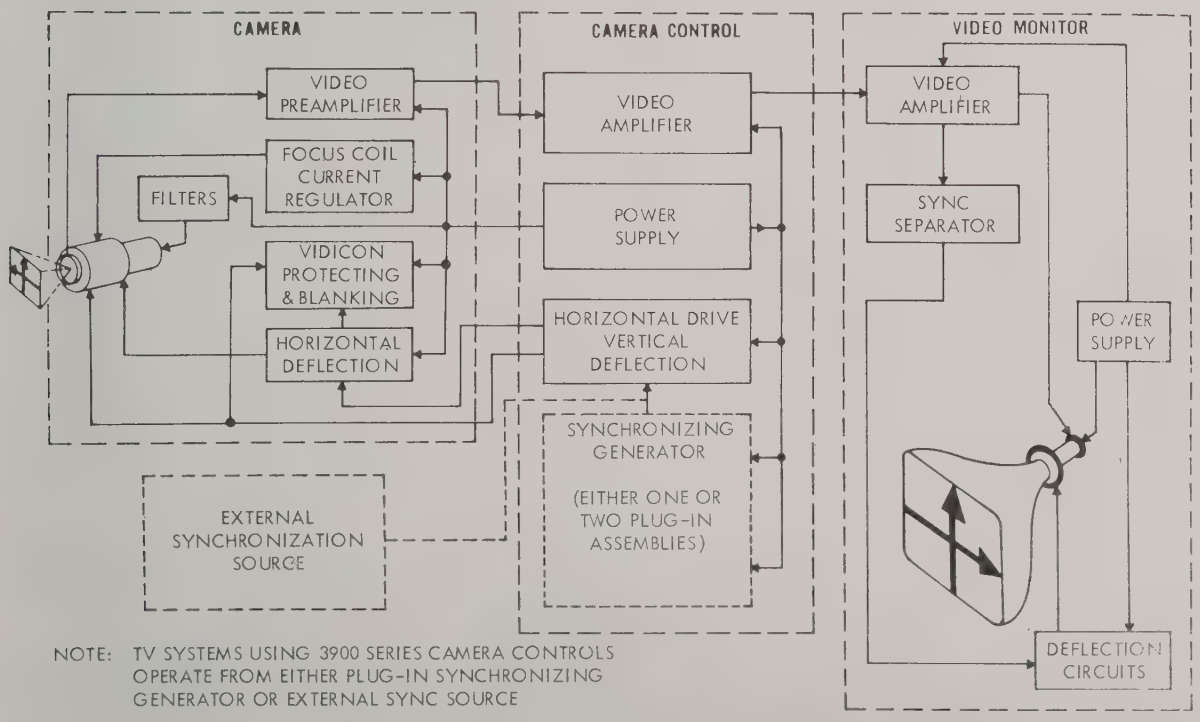


Figure 3-1. Basic Block Diagram of Television System Using 3000 Series Cameras and 3900 Series Camera Control

3.2.1. 10-MEGACYCLE PREAMPLIFIER. Figure 3-3a is a simplified schematic diagram of the video preamplifier assembly used in 525-line and 729-line systems. Signals from the vidicon target electrode appear across R104, and are amplified by the four-transistor preamplifier before application to the video amplifier in the camera control.

Input stage Q101, a low-noise NPN amplifier, provides amplification of the vidicon output signal for application to the feedback amplifiers, Q102 and Q103. Vidicon output impedance, L101, R102, Q101, and distributed capacities, result in a high frequency response peak. Compensation for this peak is performed by complementary circuitry in the video amplifier assembly, as illustrated in Figure 3-4.

Q104, the emitter-follower output stage, provides a low-impedance output to the video processing amplifiers. Overall current gain of this video preamplifier circuit is approximately 4.0×10^4.

3.2.2. 20-MEGACYCLE PREAMPLIFIER. This preamplifier is basically the same as that described under 3.2.1. above, excepting the addition of another stage (Q104 in Figure 3-5a). Q104 triples the signal from the preceding stage. Note that this stage---not present in the 10-megacycle preamplifier---inverts polarity of the video signal. If preamplifiers are changed to convert from one type of system to another (specifically, 525-line or 729-line to 873-line or 945-line---or vice versa), it is necessary to invert the signal polarity by repositioning a jumper in the video amplifier assembly. (Refer to the camera control manual.)

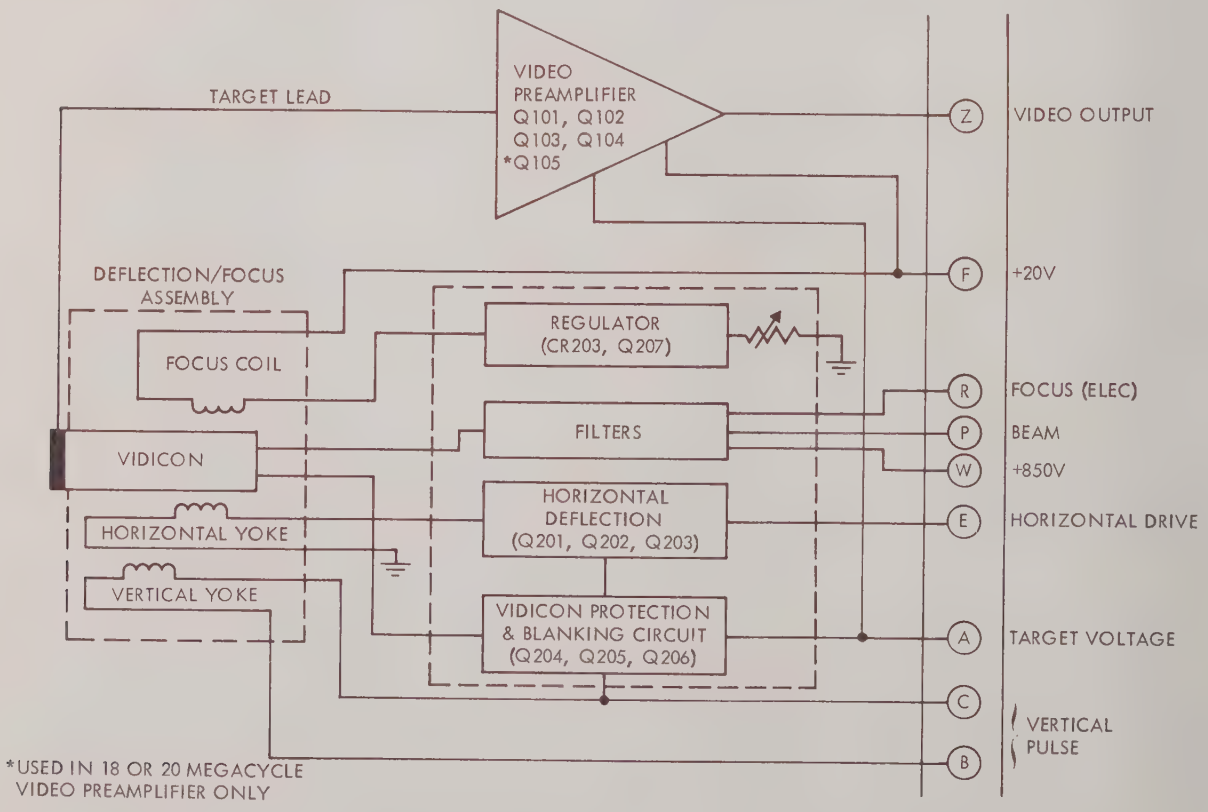


Figure 3-2. Basic Block Diagram of 3000 Series Television Cameras

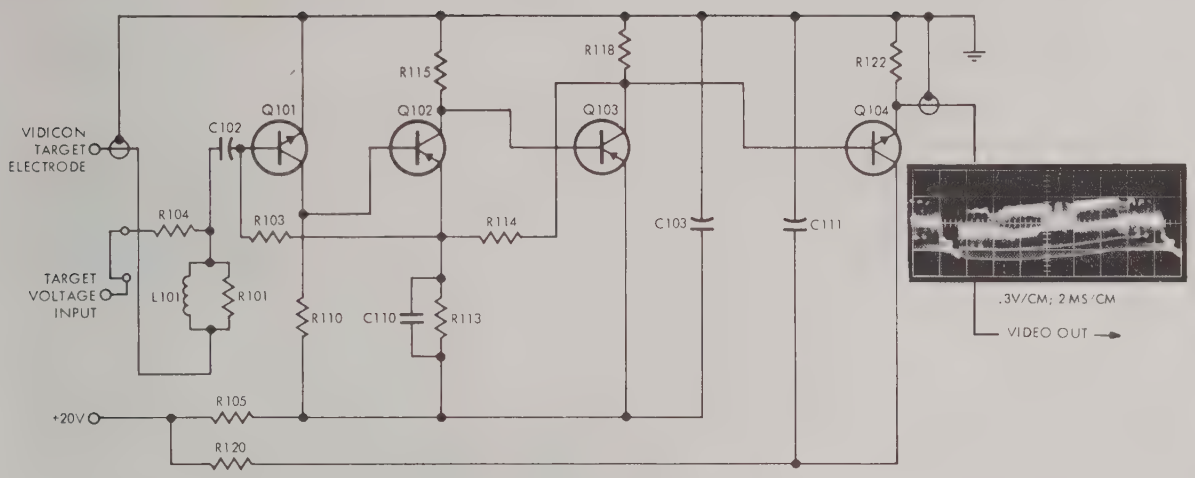


Figure 3-3a. Simplified Schematic Diagram, 10-Megacycle Preamplifier (Units 3-0061 and ON)

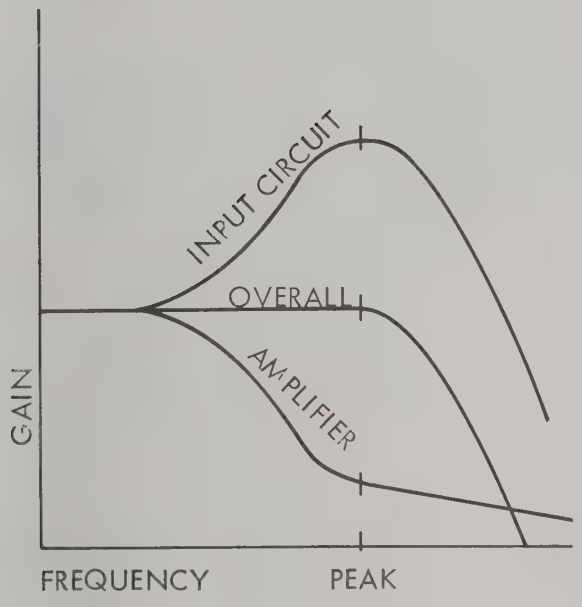


Figure 3-4. Response Curves

Overall current gain of the 20-megacycle video preamplifier is 3.2×10^4.

3.2.3. EARLY PRODUCTION PREAMPLIFIERS. As indicated below Figures 3-3b and 3-5b, these are simplified schematic diagrams of early production preamplifiers having 10-mc and 20-mc bandwidth, respectively. Operation of these units is similar to the later preamplifiers described under 3.2.1. and 3.2.2. However, input stage Q101 in the early units is a PNP emitter follower which provides an impedance transformation between the high-impedance vidicon output and the lower impedance of the feedback amplifiers (Q102 and Q103).

Note that the polarities of early and late units are opposite; i.e., early 10-mc and late 20-mc units are of identical polarity, and the early 20-mc and late 10-mc units are of the same polarity. Should changing from one type of preamplifier to another produce a negative image on the system monitor, change connection of the polarity jumper in the video assembly. (Note that gain should be watched during such change to avoid overdriving the video signal.)

3.3. DEFLECTION CIRCUITRY

The deflection assembly of 3000 series cameras incorporates three major cir-

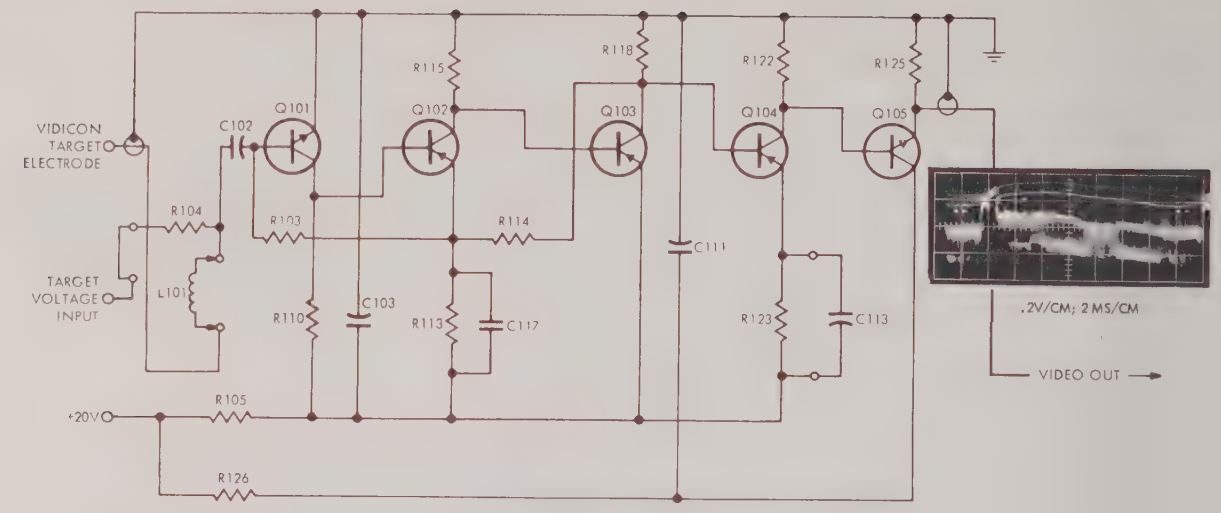


Figure 3-5a. Simplified Schematic Diagram, 20-Megacycle Preamplifier (Units 4-0036 and ON)

cuits: horizontal deflection, vidicon blanking and protection, and focus coil current regulator.

3.3.1. HORIZONTAL DEFLECTION. As shown in the simplified schematic diagram of Figure 3-6, horizontal drive pulses from the system synchronizing generator are applied to Q201, a PNP switch. Emitter follower Q202 provides additional current gain to drive output stage Q203, a transistor switch; the voltage pulses generated in this circuit are applied to the horizontal deflection coil.

As the output transistor is cut off, the collector current "rings" in the tuned circuit formed by L201, L202, and C205. The first ring excursion is the pulse which is applied to the horizontal yoke; diode CR201 clips succeeding rings. Toroid L202, which is in series with the horizontal deflection yoke, increases the Q of the circuit to improve sweep linearity.

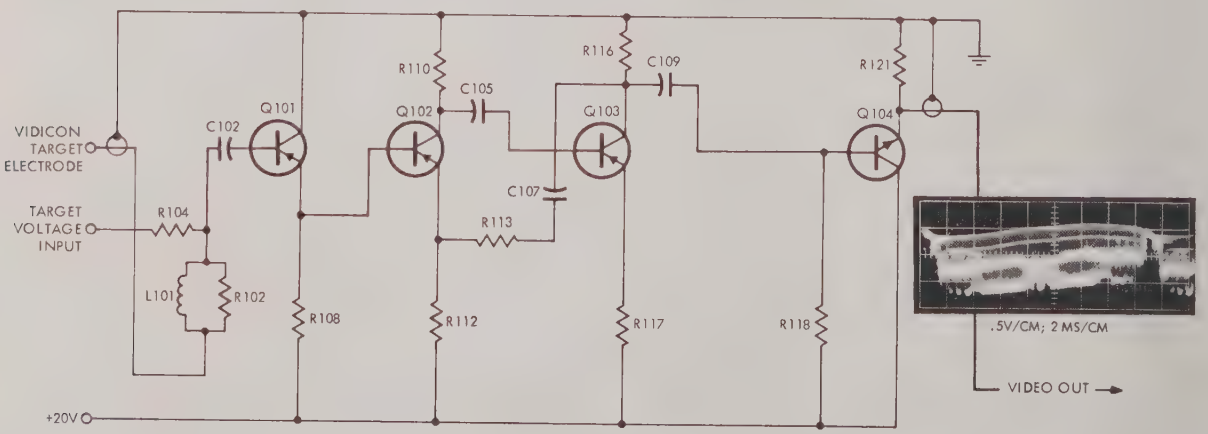


Figure 3-3b. Simplified Schematic Diagram, 10-Megacycle Preamplifier (Units 3-0001 Through 3-0060)

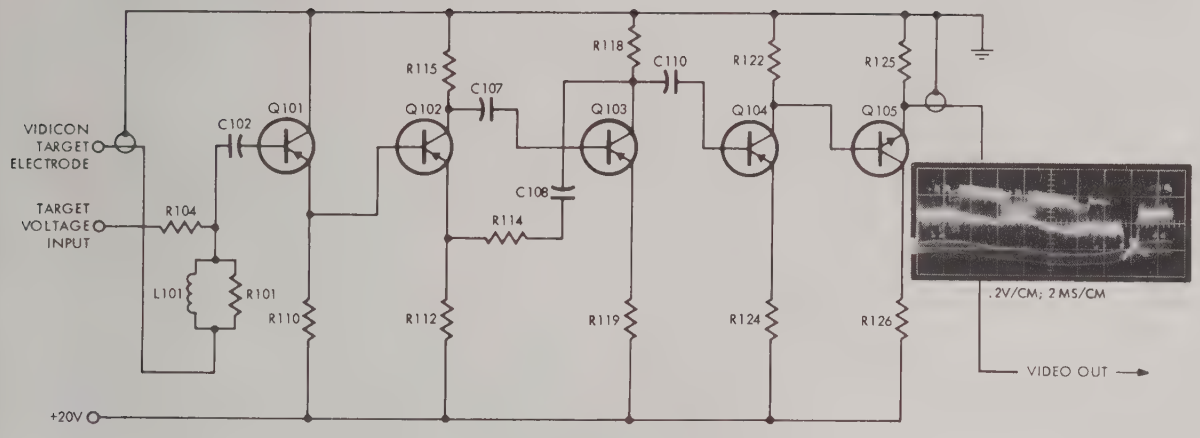


Figure 3-5b. Simplified Schematic Diagram, 20-Megacycle Preamplifier (Units 4-0001 Through 4-0035)

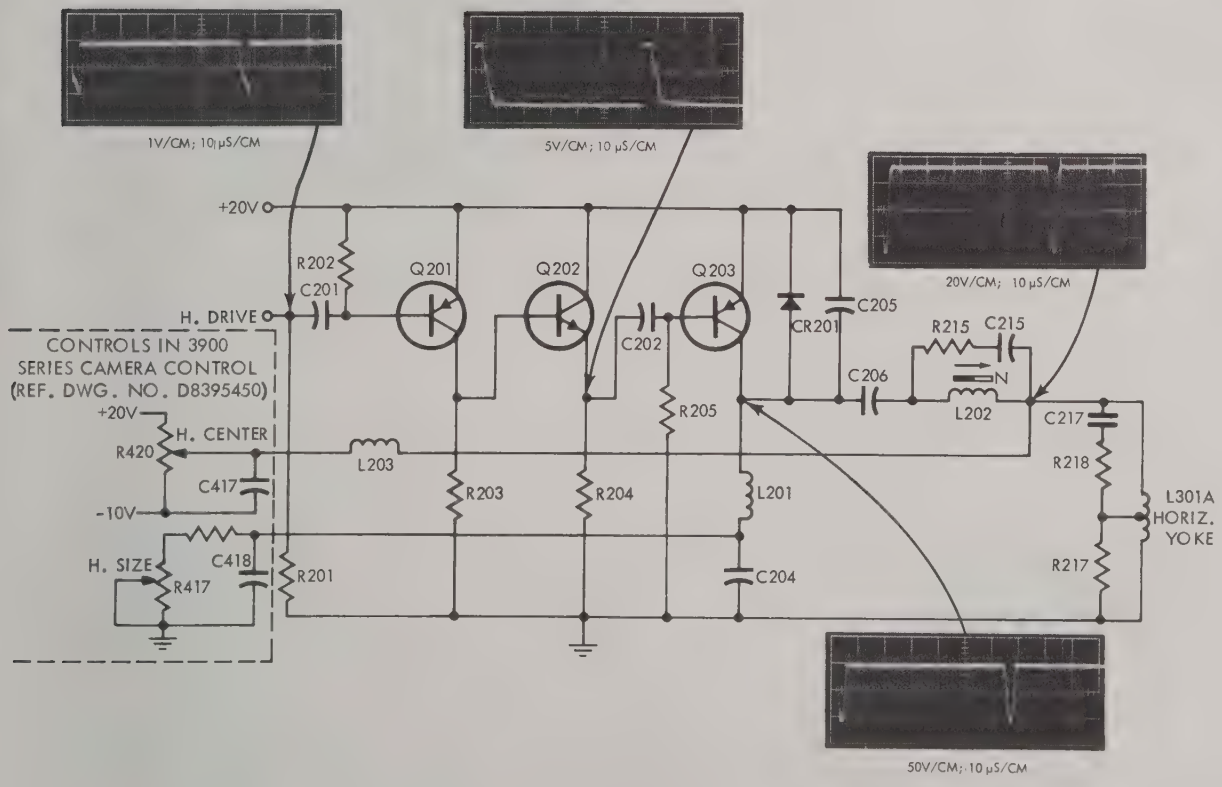


Figure 3-6. Simplified Schematic Diagram of Horizontal Deflection Circuit

A DC voltage superimposed on the horizontal drive pulse at the camera control deflection assembly, and adjusted by the H. SIZE control, sets the maximum yoke current, and therefore, the horizontal size.

Another DC voltage originating in the camera control (adjusted by the H. CENTER control) is applied to the horizontal deflection yoke through isolation choke L203. Adjustment of H. CENTER varies the DC current through the horizontal deflection coil to position the sweep pattern on the vidicon face.

3.3.2. VIDICON BLANKING AND VIDICON PROTECTION. During normal operation, vidicon cathode bias is approximately -10 volts. This bias must be applied only when both the horizontal and vertical deflection signals are at near-normal operating amplitudes. Failure of either deflection signal would limit scanning in the respective direction to a narrow path, with resultant burning of the over-bombarded target area. To prevent such occurrence, a circuit is provided which automatically cuts off the vidicon beam if either deflection signal fails (Figure 3-7).

Transistors Q205 and Q206 are connected to sample the horizontal and vertical deflection circuit outputs as they appear across the respective yokes. When both positive-going deflection signals are present---vertical at the base of Q205 and horizontal at the base of Q206---neither transistor will conduct. In the absence of either deflection signal, both transistors are biased into conduction and the common collector voltage goes from -10 volts to +20 volts. Because this voltage appears in the collector load resistor (R208) to which the vidicon cathode is connected, the

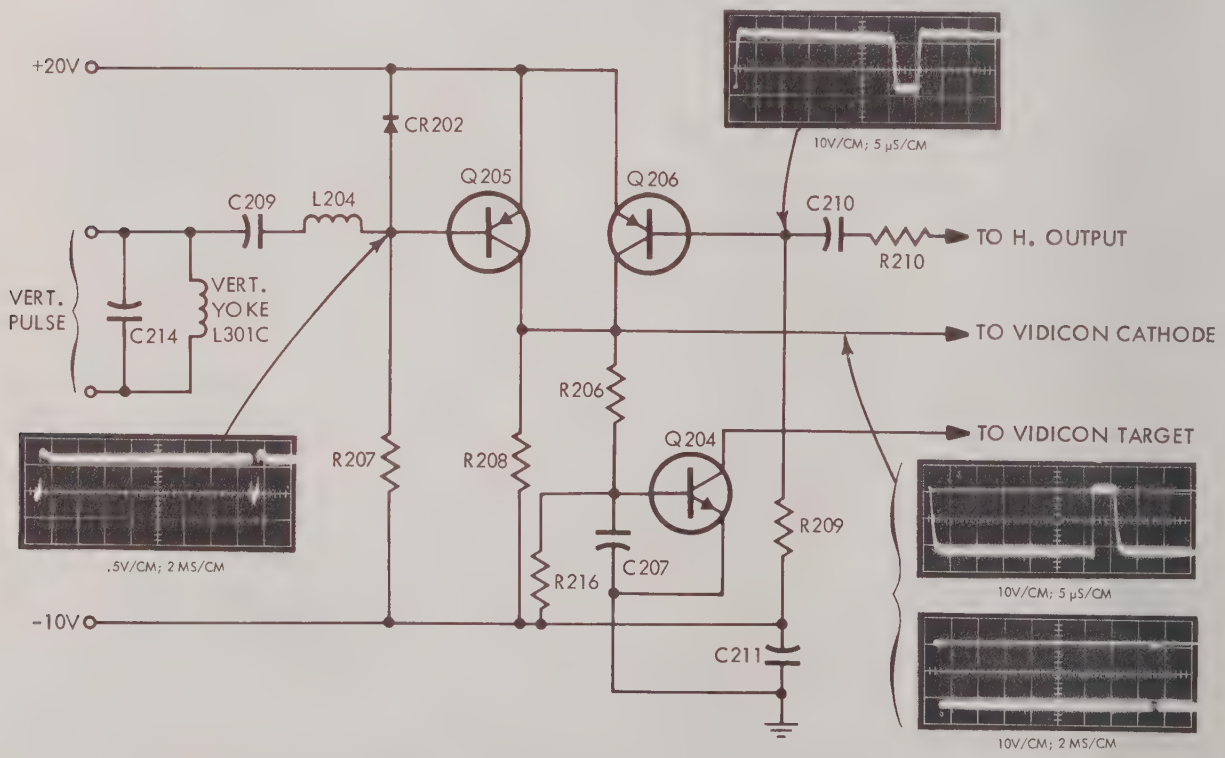


Figure 3-7. Simplified Schematic Diagram of Vidicon Blanking and Protection Circuit

+20 volts cuts off the vidicon beam current, protecting the target from burning.

Q204 removes vidicon target voltage in the event of sweep failure.

Deflection retrace signals also drive Q205 and Q206 into conduction; thus the protection circuit functions during the retrace period as the vidicon blanking circuit.

3.3.3. FOCUS CURRENT REGULATOR. Current through the focus coil is held constant by a current regulator circuit (Figure 3-8). Current level is preset by adjustment of R213.

3.4. FILTER CIRCUITRY

Filters are installed at the vidicon socket (Figure 3-9) to reduce the effects of disturbances which may be coupled to lines in the cable.

CR301, installed in the filter assembly, zeners at 6.8 volts, thus preventing the nominal 6.3 volts of the filament supply from exceeding 6.8 volts across the vidicon filament.

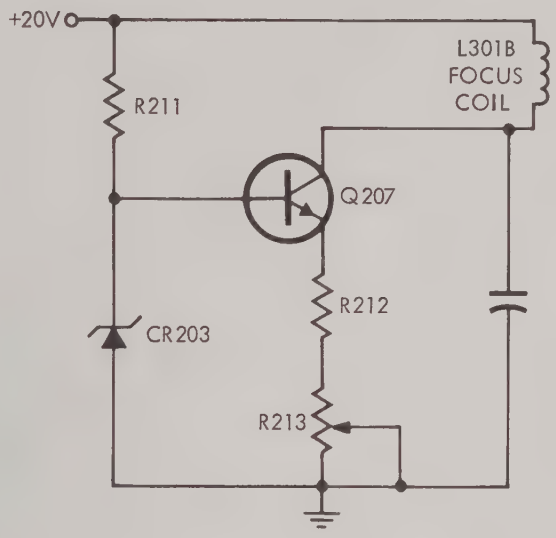


Figure 3-8. Focus Coil Current Regulator Circuit

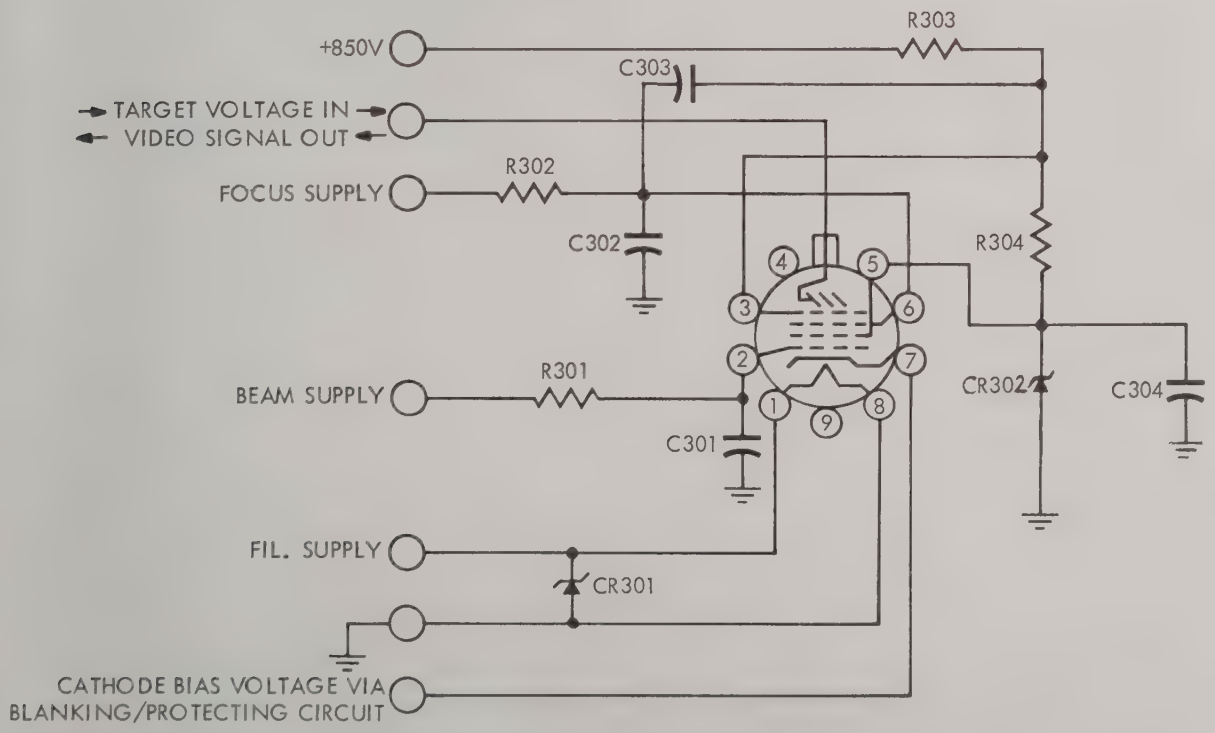


Figure 3-9. Filter Assembly Circuitry

Section IV
MAINTENANCE

4-1 INTRODUCTION

Preventive and corrective maintenance procedures for cameras of the 3000 series are facilitated by the plug-in construction of major circuitry and the accessibility of interconnecting wiring. Procedures described here are supported by photographs and drawings essential to maintenance by competent, trained service personnel. Additional reference is made to the instruction manual for the associated 3900 series camera control, which equipment is a necessary part of the camera system.

4.2. PREVENTIVE MAINTENANCE

Preventive maintenance of 3000 series cameras consists of periodic inspection and cleaning and, if advisable, vidicon replacement.

4.2.1. CLEANING. The glass faceplate of enclosed-lens models should be inspected periodically and cleaned as required. Periodicity of inspection will be determined by the installation environment.

Particles of dust or drops of moisture on the faceplate appear greatly magnified when televised. The blurring of images and decrease in lighting may be only a minor annoyance under certain conditions. At other times, the loss of light may seriously reduce sensitivity; large spots may obscure portions of the image.

The faceplate should be cleaned carefully with a non-abrasive cleaner, such as one of the spray types of glass cleaner or lens cleaner, and dried with a lens tissue or other soft, lintless tissue.

4.2.2. HUMIDITY INDICATOR. In enclosed-lens models, a dessicant-replacement indicator is mounted within the camera housing in a position which allows its inspection from outside the camera through the glass faceplate. This indicator may consist of a complete label bearing color spots, or---in cameras incorporating lenses and/or lens supports which conceal the housing interior---only pieces of the color spots may be used.

The normally blue color spots change to pink as humidity within a sealed housing increases to a specified percentage. Numbers on the color spots indicate the percentage of humidity required to change the color from blue to pink. When the spot marked "40" becomes pink, humidity has reached 40 percent, an indication that the housing seal is not perfect and that humidity within the housing could increase. When the "50" color spot turns pink, 50-percent humidity is indicated, and a thorough inspection should be made to locate and eliminate the point at which the housing seal integrity has been breached, before replacing the dessicant pack.

NOTE

Cameras should be opened only in dry atmospheres, and then only if freshly reactivated dessicant packs are available for installation.

4.2.3. DESSICANT REPLACEMENT. The following procedure is recommended for replacing the dessicant pack:

a. Remove the electrical assembly from the housing as outlined under paragraph 2.4.2;

b. Cut the tape which holds the dessicant pack to the electrical assembly and remove the pack. Remove excess tape from the assembly;

c. Activate a fresh dessicant pack (1-unit size, MIL-D-3464) and distribute the contents evenly throughout the envelope;

d. Place the pack around the focus-and-deflection-coil assembly as shown in Figure 4-1. Place lengths of masking tape across the pack and secure to the frame as shown in Figure 4-1. Note that sufficient tape is used to insure stability of package configuration; shifting of dessicant within the pack could cause bulges which might interfere with accessory mounting or operation, or permit tearing of the package envelope;

e. Replace camera in housing as outlined under paragraph 2.4.2.

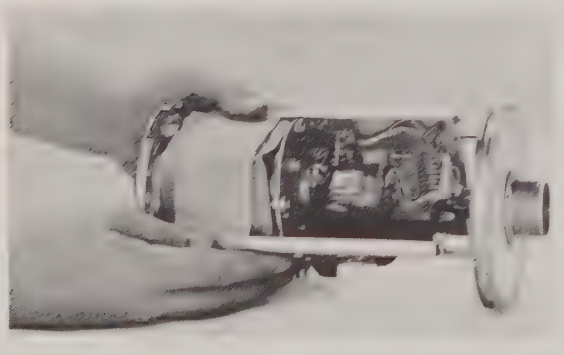


Figure 4-1. Installing Dessicant Pack

4.2.4. CAMERA CONTROL ADJUSTMENTS AS PREVENTIVE MAINTENANCE. Adjustments within the camera control may be advisable due to slight circuit changes which occur as components age in operation. These adjustments, which are requisite to maximum picture quality, are detailed in the manual for the 3900 series camera controls.

4.3. CORRECTIVE MAINTENANCE

Corrective maintenance of 3000 series cameras will consist of standard techniques for television system troubleshooting, diagnosis and location of malfunctions, and replacement of components as required.

Table 4-1 is provided as a guide for basic troubleshooting in the system. Additional data is furnished in the manual for 3900 series camera controls.

4.3.1. PART LIFE EXPECTANCIES. With the exception of the vidicon tube, only solid state stages are used in 3000 series cameras. All components are used well within the ratings of the respective component manufacturers. Components are derated in accordance with good industry practice to insure increased component life and to minimize the possibility of interrupted operation.

Vidicons have a finite life which---depending upon the type of vidicon and the application---may be well in excess of 1000 hours.

Vidicon usage in brightly lighted surroundings---barring direct target exposure to extreme brilliance---will result in a longer useful life than usage in dim illumination, because the latter condition re-

Table 4-1. Troubleshooting Guide

DIFFICULTY	PROBABLE CAUSE	REMEDY
No picture	Malfunction in camera control unit	Check control unit circuits -- perform maintenance
	Cabling failure	Check continuity in cables and connectors -- replace or repair
	Cutoff bias on vidicon cathode (pin 7) -- +20 volts or more	Check deflection signals; check wiring between deflection circuit board and coil assembly -- if normal, replace circuit board
	Burned out vidicon -- check for glow at base	Replace vidicon
	New vidicon -- not properly oriented in socket	Reorient vidicon -- short pin to groove in socket
	New vidicon -- not completely seated with electrode against spring	Tighten tube in its seat
	Video amplifier failure	Replace video amplifier circuit board
Picture very faint or reversed (negative) image or both	Improper voltages	Check control unit -- perform maintenance
	Weak vidicon	Replace vidicon
	Loss of video gain	Replace video amplifier circuit board

Table 4-1. Troubleshooting Guide (Contd)

DIFFICULTY	PROBABLE CAUSE	REMEDY
Distorted picture -- loss of height or width or both	Improper deflection signals	Check control unit and camera deflection board -- perform maintenance
	Failure of deflection coil(s)	Replace coil assembly
Fuzzy picture	Improper lens setting	Adjust lens
	Malfunction in control unit	Check control unit -- perform maintenance
	Open circuit or shorted. turn in focus coil	Replace coil assembly
	Malfunction in focus current regulating circuit	Replace deflection circuit board

quires increased dark current which depletes the target at a more rapid rate. In either case, vidicon failure is typically gradual rather than abrupt, and is observed as a very slowly decreasing sensitivity of the target. This characteristic will necessitate occasional slight increase of the SENS control setting over long periods of time when used in the same system under constant illumination conditions.

The glass faceplate of enclosed-lens models could be eroded by extensive exposure to dusty, gritty environments, especially if driving winds are present. The "O" ring seals could be damaged by careless handling, or could become ineffective if proper precautions are not taken to prevent their contact with erosive substances. Abrasion by housing surfaces during insertion of the electrical assembly can be minimized by use of a safe lubricant such as an approved silicon- or vegetable-base grease or spray.

4.3.2. VIDICON REPLACEMENT. The vidicon should be replaced only with extreme caution. The following procedure should be used for cameras equipped with internally mounted lenses of fixed focal length:

a. Remove the electrical assembly from the housing as outlined under 2.4.2;

b. Loosen the set screw of the "C" mount adapter with the small hex wrench as illustrated in Figure 2-5. Remove the adapter and lens to a safe place. If adapter remains in lens well when lens is removed, use the "C" mount spanner to remove the adapter as shown in Figure 2-6;

c. Loosen and remove the vidicon lock ring with the "C" mount spanner;

d. Gently disengage the socket assembly from the vidicon pins; loosen the vidicon clamp (Figure 4-2);

e. Slide the vidicon forward and grasp it at the front end as it emerges from the lens well;

f. Insert replacement vidicon in the lens well and slide it rearward until the pins will engage the socket assembly;

g. Rotate the vidicon to place the short pin at the side which aligns it with the groove on the side of the socket (this should be the side of the socket having different capacitors mounted side-by-side, and directly opposite to the side mounting the two identical capacitors, shown in Figure 4-2);

h. Insert the vidicon lock ring and tighten in place while holding the vidicon-and-socket assembly in position; tighten the lock ring only enough to prevent axial vidicon movement;

i. Tighten the vidicon clamp sufficiently to prevent any tube movement; connect entire television system and turn on;

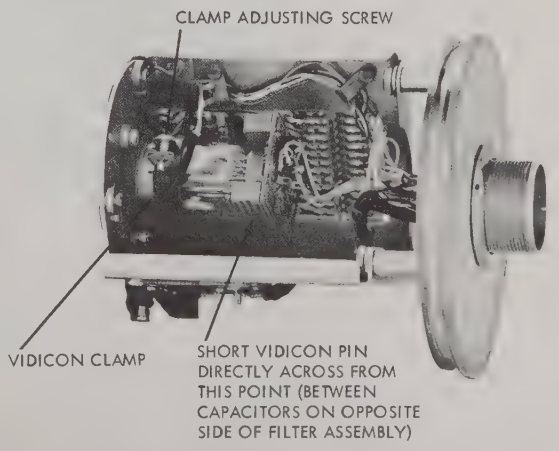

CLAMP ADJUSTING SCREW
VIDICON CLAMP
SHORT VIDICON PIN DIRECTLY ACROSS FROM THIS POINT (BETWEEN CAPACITORS ON OPPOSITE SIDE OF FILTER ASSEMBLY)

Figure 4-2. Vidicon Replacement Orientation

j. While system is warming to operating temperature, wipe the face of the vidicon with a lens tissue to remove fingerprints, etc., and install the lens-and-adapter assembly as outlined under 2.4.2. When optimum focus is obtained, examine the picture on the monitor. The vidicon raster should be centered on the vidicon target. This is most easily determined if the camera is mounted in the camera test jig with the glass resolution pattern installed.

k. Set lens f-stop at f/8; set lens focus adjustment for proper focus.

l. Follow setup instructions on the door of camera control or those listed in Section II of the camera control manual.

m. Adjust monitor vertical and horizontal size so that the edges of the raster are visible.

n. With 750 volts at pin 3 of the vidicon, adjust FOCUS control in the camera control power supply assembly to obtain 500 volts at vidicon pin 6. Adjust current regulator potentiometer on camera deflection board for proper focus. Drop across focus coil should be approximately 10 volts.

o. With SENS. control at zero, connect scope (set at high gain and horizontal rate) to video output of the camera. Rotate vidicon for null in blanking-signal output. The lens should then be optically focused.

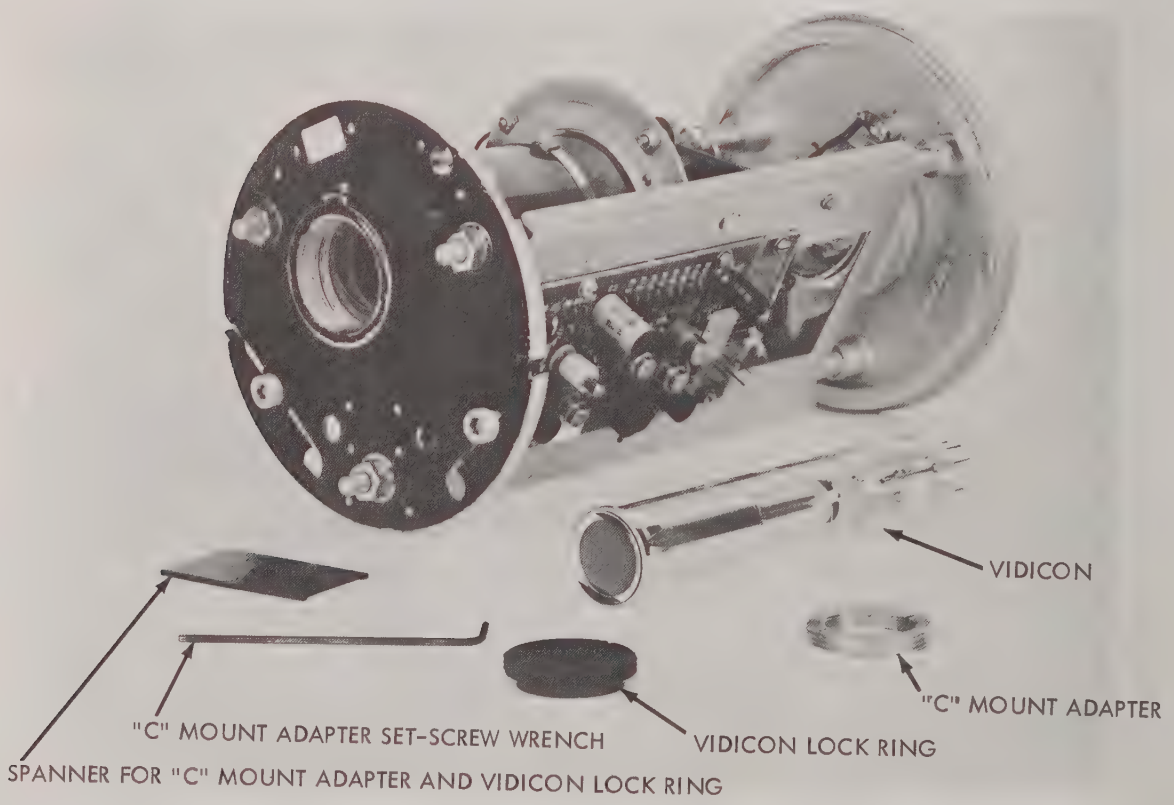

VIDICON
"C" MOUNT ADAPTER
"C" MOUNT ADAPTER SET-SCREW WRENCH
VIDICON LOCK RING
SPANNER FOR "C" MOUNT ADAPTER AND VIDICON LOCK RING

Figure 4-3. Camera with Vidicon Removed, Showing Removal Tools

p. Adjust H. CENTER and V. CENTER controls to center raster on target and adjust vidicon alignment magnets to provide best corner resolution (usually best overall resolution) as detailed under 4.3.3.

q. Adjust H. SIZE and H. CENTER so that the small, white, horizontal arrowheads on the test chart are visible at the edges of the raster.

CAUTION

DO NOT ADJUST H. SIZE CONTROL PAST THE POINT WHERE 20% OVERSCAN IS OBTAINED!

r. If additional raster orientation is required, refer to camera control instruction manual under DEFLECTION TESTS.

4.3.3. MAGNET ADJUSTMENT. When a vidicon has been installed, the alignment magnets must be adjusted to center the beam on the target. These magnets (Figure 4-4) are identifiable as polarized "washers" mounted by screws at the bottom of the frame cross-section which serves as the rear retainer for the deflection-and-focus-coil assembly. The adjustment procedure is as follows:

a. With system connected and in operation and image centered on the vidicon, insert screwdriver in the adjustment slot of the FOCUS control on the power supply assembly of the 3900 series camera control (refer to 3900 series manual) and rock the control while watching the image on the associated monitor. Rocking the control will rotate the entire picture on the monitor screen.

b. Observe the orientation of the center of the picture (best noted if the televised image is a test pattern) and adjust the camera beam-adjustment magnets so that rocking of the focus control causes the least displacement of the center portion in both the horizontal and vertical directions. (i.e., considering the center of the picture to be the hub of a wheel, adjust to present an effect which indicates the least misalignment of the "axle" on which it turns.)

Individual vidicon characteristics will vary, and an occasional tube will be found which provides best resolution at the corners of the picture when the magnet adjustment is set to give other than minimum displacement of the picture center. In such cases, open the lens to the widest aperture and observe the corner resolution at the various conditions of center displacement; then choose a compromise adjustment. After adjustment, a sealant should be applied to the magnets to prevent accidental rotation.

4.3.4. PLUG-IN CIRCUITRY REPLACEMENT. The two main circuit board assemblies of 3000 series cameras are secured by screws to the chassis framework (Figure 4-5). Removal of these screws will allow a circuit assembly to be disconnected from the respective associated connector board by sliding the circuit assembly forward until the connecting pins are free of the mating terminals. When removing the video board, the target lead must be unsoldered (Figure 4-6).

4.3.5. FILTER ASSEMBLY REPLACEMENT. The filter board assembly is integral with the vidicon socket (Figure 4-7). To replace this assembly, disengage

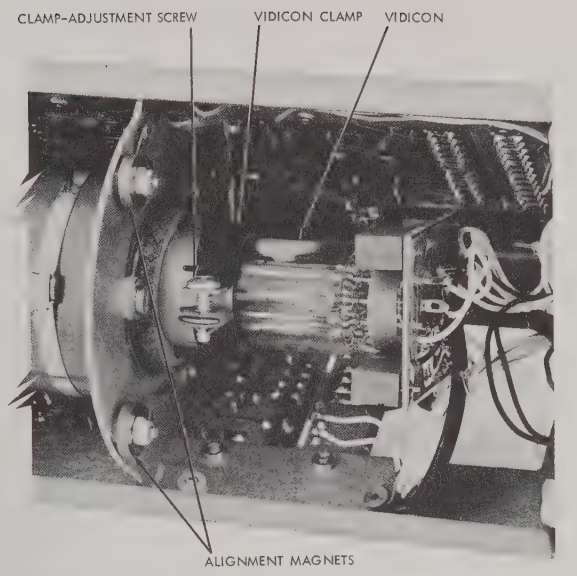


Figure 4-4. Alignment Magnet Locations

socket from vidicon pins, and unsolder leads from the assembly. Reconnect and solder leads to replacing socket-and-filter assembly, then replace socket on vidicon pins.

4.4. SERVICE PROCEDURES

The component layout on the etched board assemblies of the camera facilitates localization of troubles. The tabulation of symptoms, probable causes, and remedies in Table 4-1 and the voltages shown on the respective schematics, will aid in locating and eliminating the more common types of malfunctions.

It is not recommended that components mounted on the etched boards be removed and replaced. The board assemblies are available as spares and it is advisable to stock one of each to avoid down time. Malfunctioning assemblies may be returned to the factory for expert service, after which they may be stocked as spares.

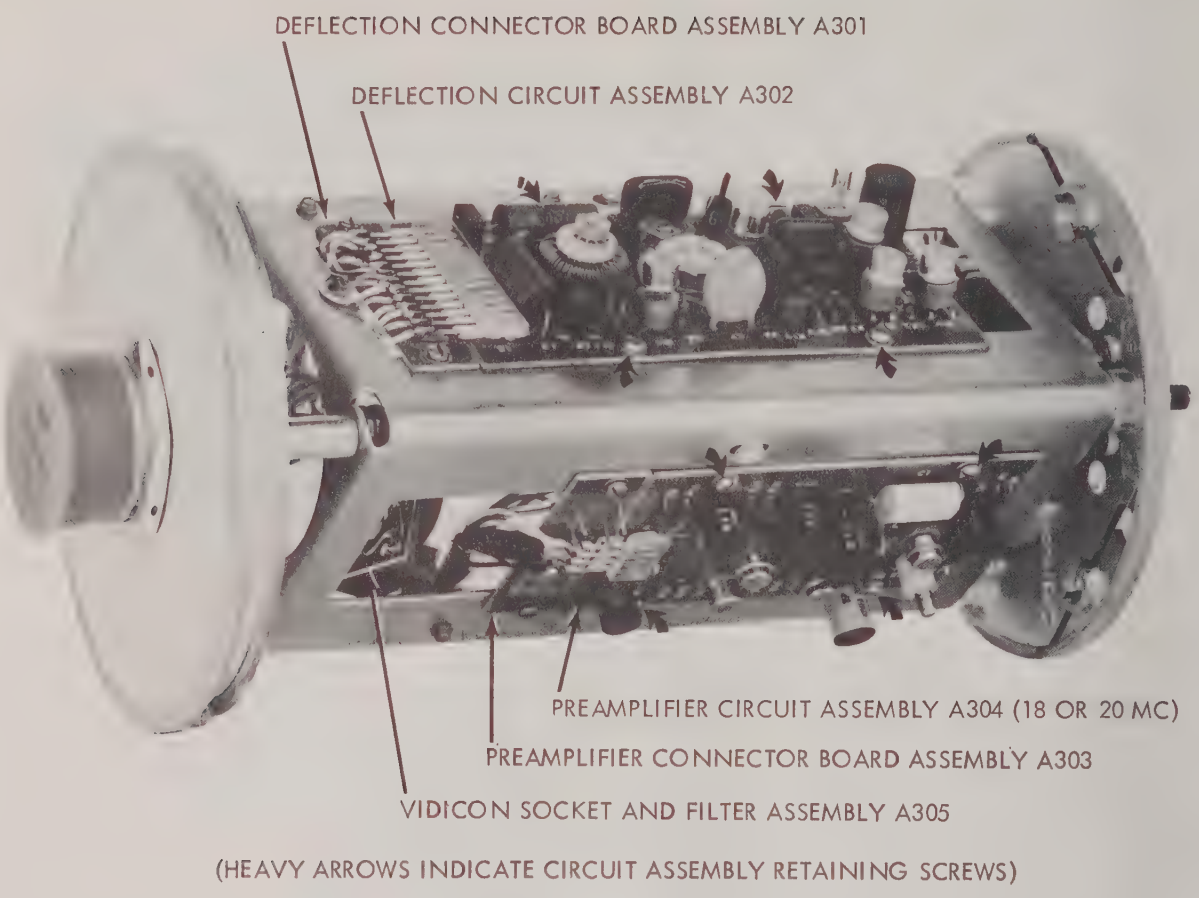

DEFLECTION CONNECTOR BOARD ASSEMBLY A301
DEFLECTION CIRCUIT ASSEMBLY A302
PREAMPLIFIER CIRCUIT ASSEMBLY A304 (18 OR 20 MC)
PREAMPLIFIER CONNECTOR BOARD ASSEMBLY A303
VIDICON SOCKET AND FILTER ASSEMBLY A305
(HEAVY ARROWS INDICATE CIRCUIT ASSEMBLY RETAINING SCREWS)

Figure 4-5. Board Assembly Identification, Showing Board-Retaining Screws

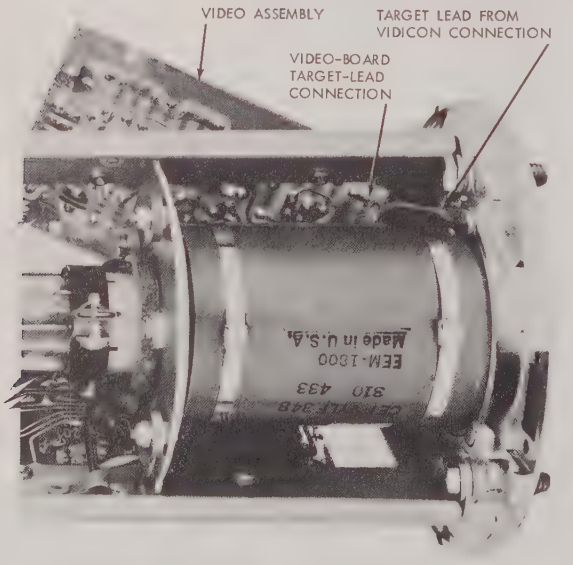


Figure 4-6. Video Preamplifier Board, Showing Target-Lead Connection

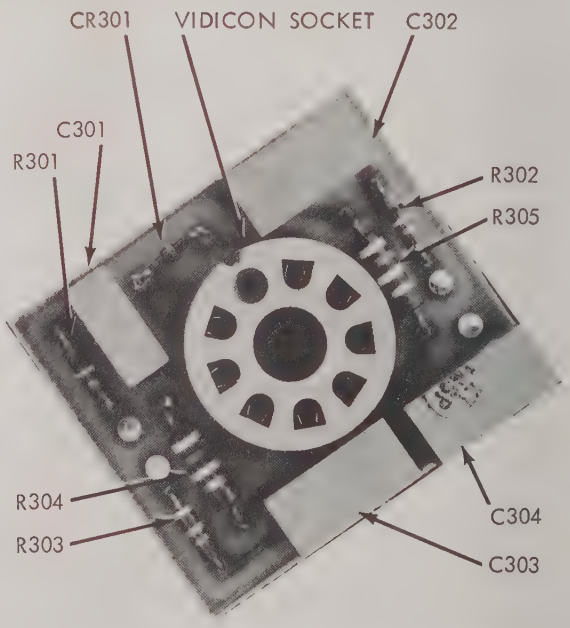


Figure 4-7. Filter and Socket Assembly

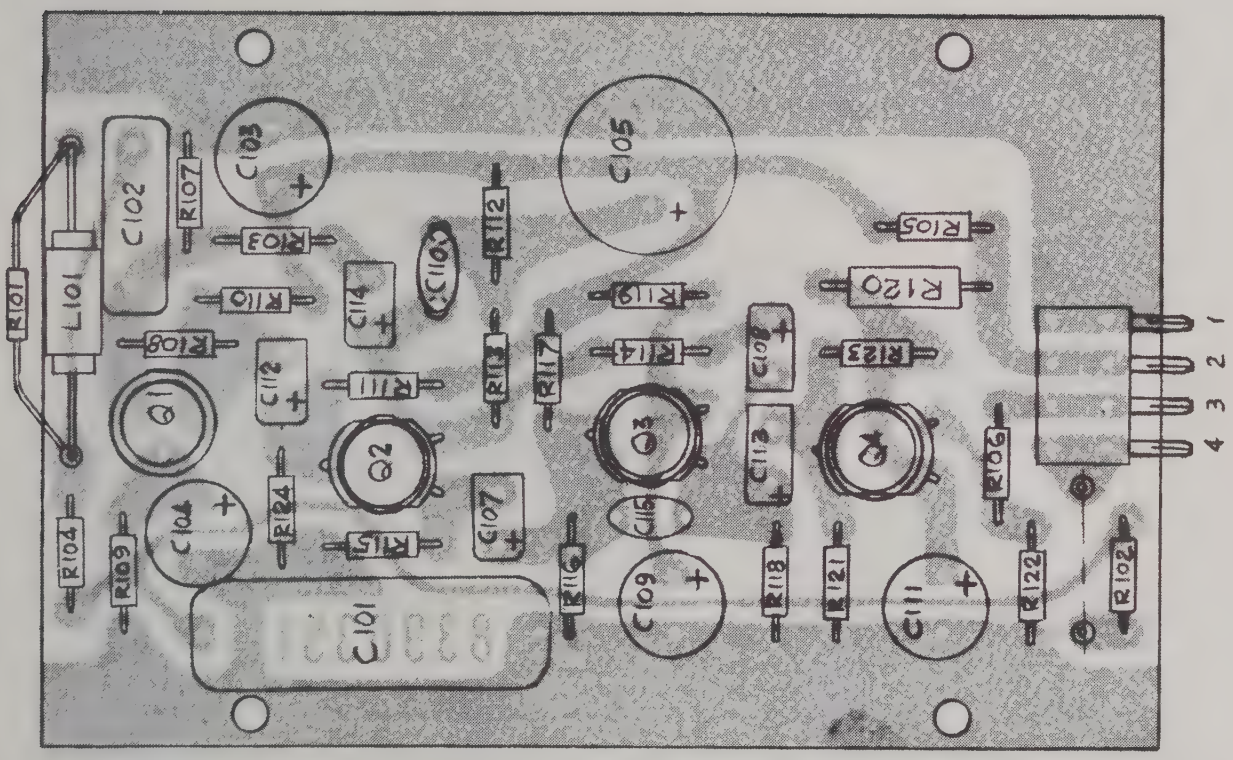


Figure 4-8. 10-Megacycle Preamplifier Assembly

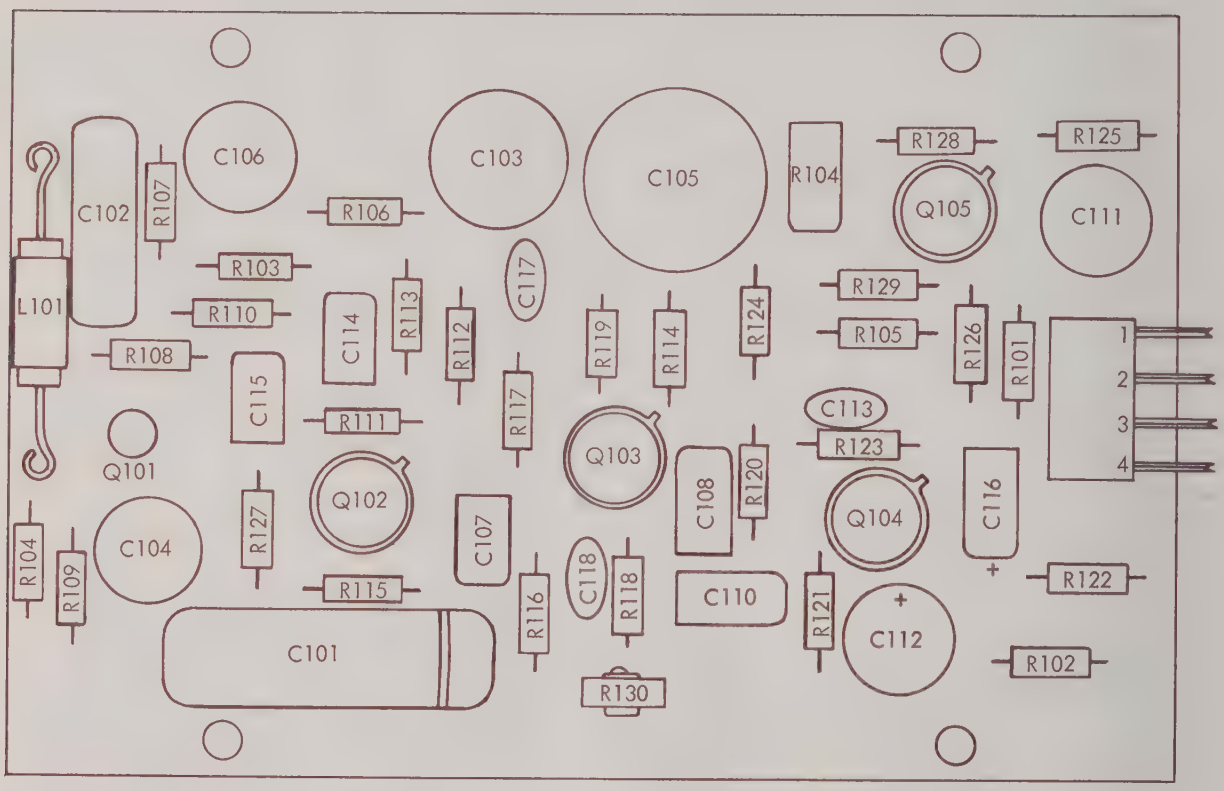


Figure 4-9. 20-Megacycle Preamplifier Assembly

4.5. MAINTENANCE SUPPORT DATA

Included in this publication for support of maintenance procedures are the simplified schematic diagrams of Section III, photographs and drawings of various camera assemblies, the listing of symptoms with probable causes and remedies in Table 4-1, the complete schematic diagrams of camera subassemblies, and a list of replacement parts. Figures 4-8 through 4-10 illustrate major circuit board assemblies.

4.5.1. SCHEMATIC DIAGRAMS. Figure 4-11 is a complete schematic diagram of the 10 mc video preamplifier assembly in standard cameras of the 3000 series; Figure 4-12 represents the 20 mc video preamplifier; Figure 4-13 is the schematic diagram of the deflection output assembly in these cameras; and Figure 4-14 is the schematic diagram of the standard 3000 series camera electrical assembly, less circuit details provided in Figures 4-11 through 4-13.

4.5.2. REPLACEMENT PARTS. Tables 4-2 through 4-4 list the replacement circuit board assemblies and individual electronic components for standard cameras of the 3000 series, with KIN TEL part numbers referenced for each applicable tabulation.

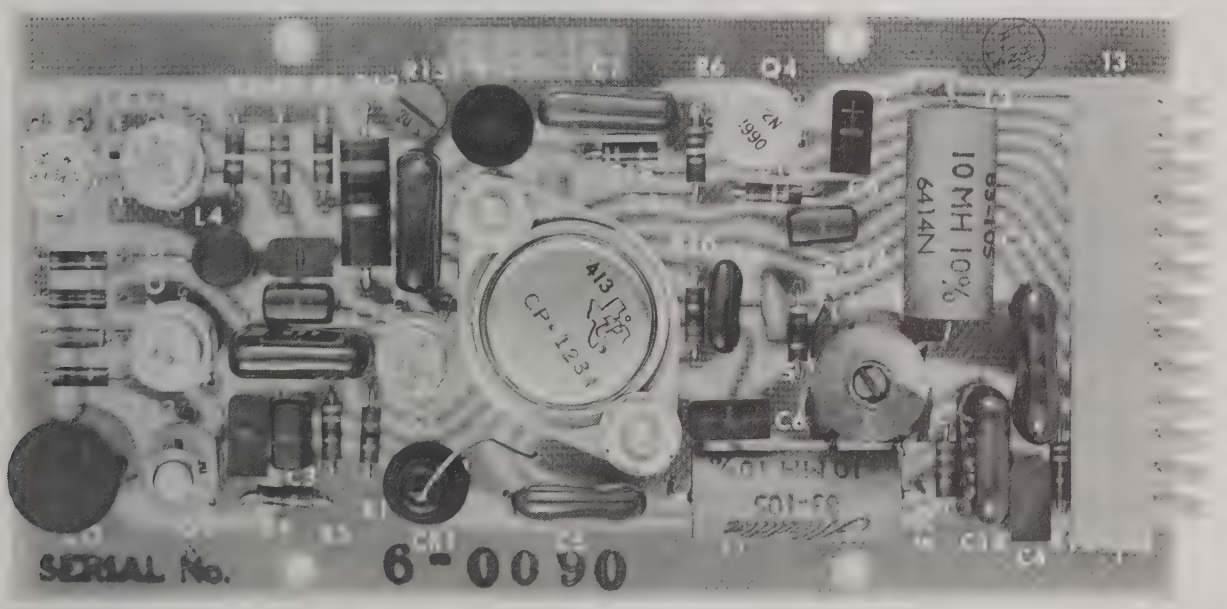


Figure 4-10. Camera Deflection Board Assembly

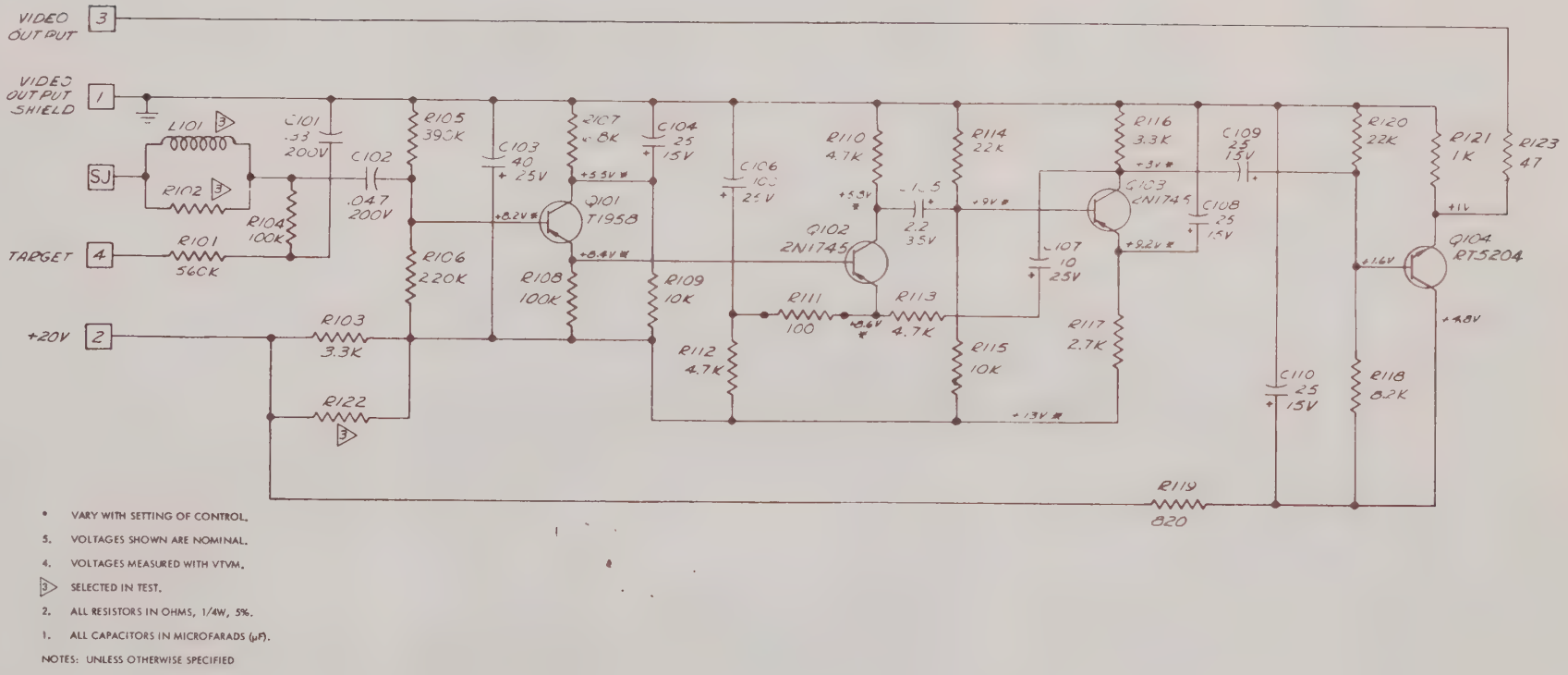
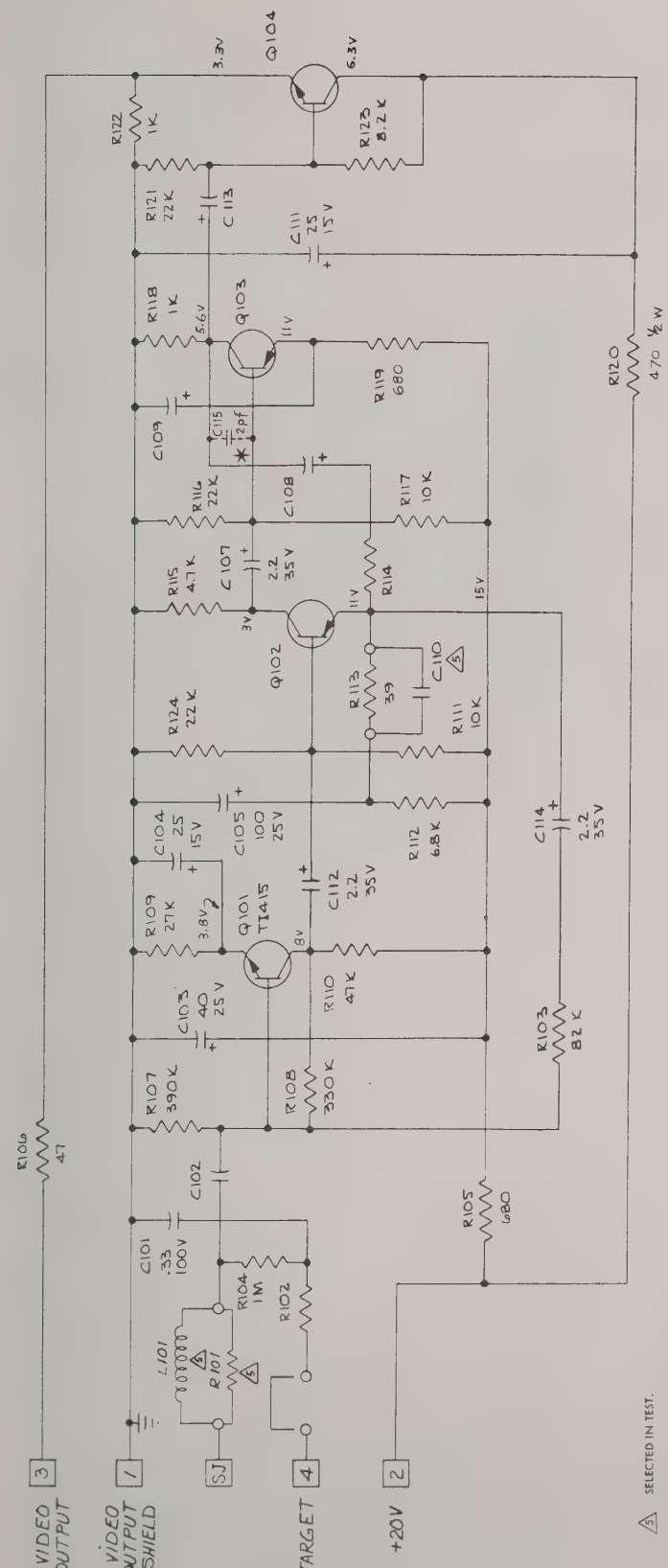


Figure 4-11a. Schematic Diagram, 10-Megacycle Preamplifier, Units 3-0001 Through 3-0060 (Drawing No. D8396112)



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITORS IN MICROFARADS (μF).
2. ALL RESISTORS IN OHMS, 1/4W, 5%.
3. VOLTAGES MEASURED WITH VTVM.
4. VOLTAGES SHOWN ARE NOMINAL.

△5 SELECTED IN TEST.

★ FOR UNIT SERIAL NUMBER EFFECTIVITY AND/OR COMPONENT VALUE NOT SHOWN, REFER TO LIST OF REPLACEMENT PARTS

Figure 4-11b. Schematic Diagram, 10-Megacycle Preamplifier, Units 3-0061 and ON (Drawing No. D8396350F)

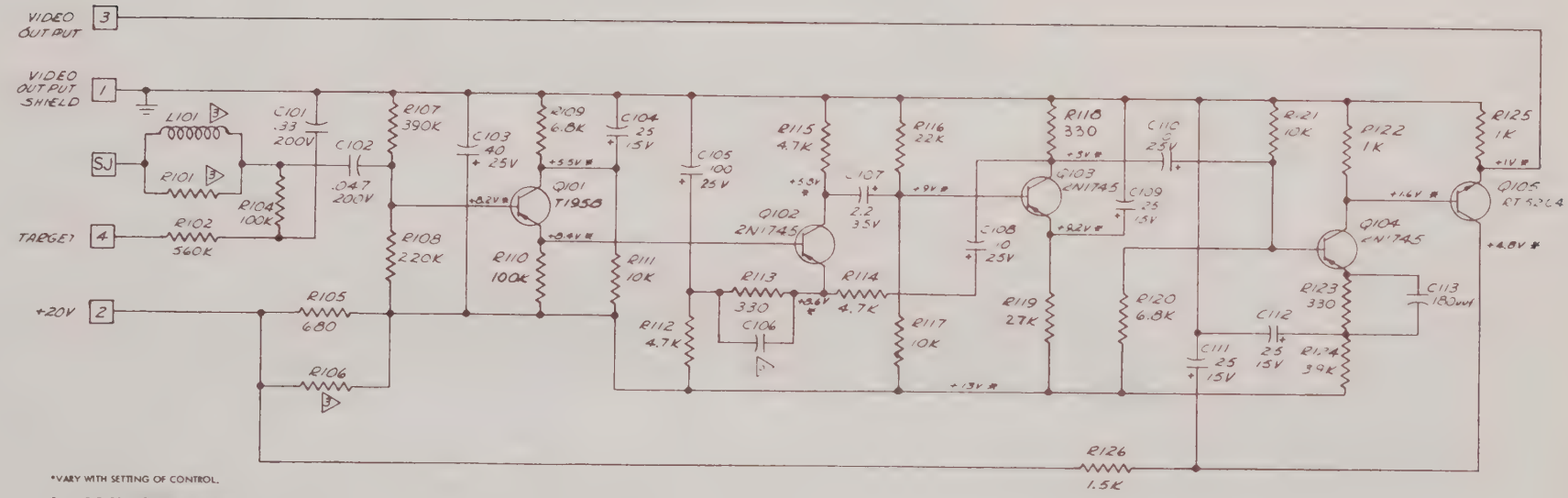
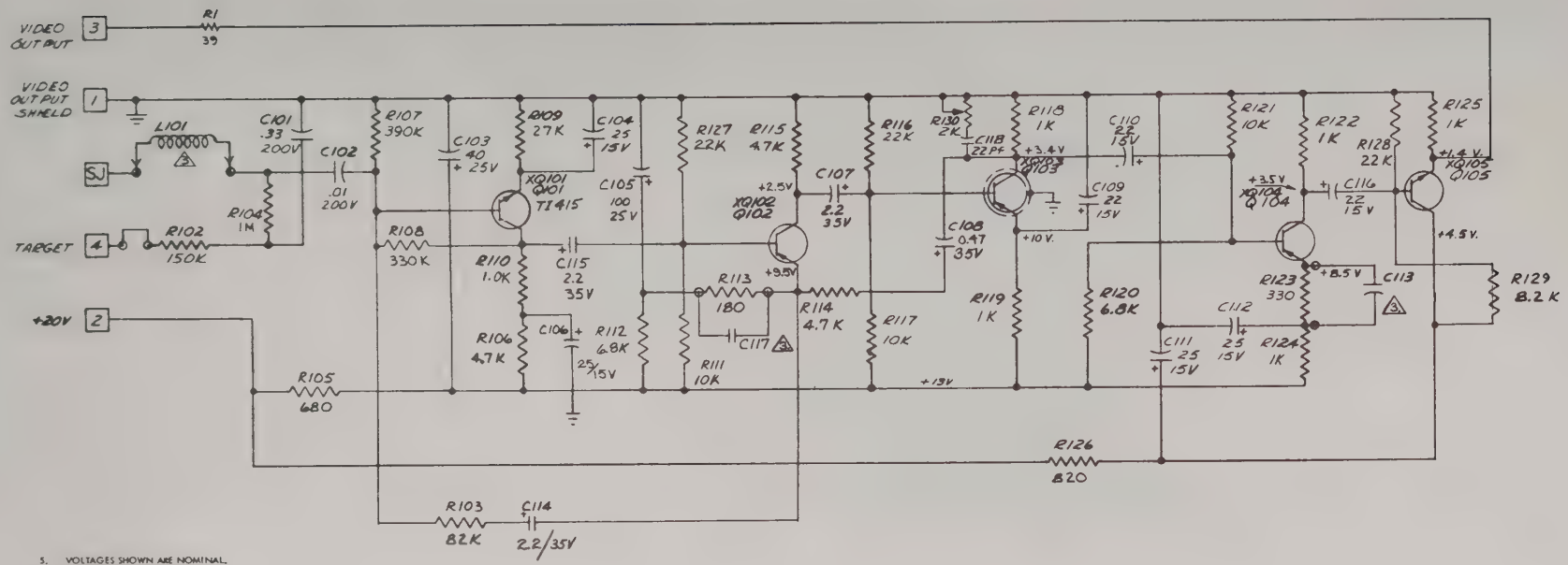


Figure 4-12a. Schematic Diagram, 20-Megacycle Preamplifier, Units 4-0001 Through 4-0035 (Drawing No. D8396100E)



5. VOLTAGES SHOWN ARE NOMINAL.
4. VOLTAGE MEASURED WITH VTVM.
3. SELECTED IN TEST.
2. ALL RESISTORS IN OHMS, 1/8W, 5%.
1. ALL CAPACITORS IN MICROFARADS (μF).

NOTES: UNLESS OTHERWISE SPECIFIED

FOR UNIT SERIAL NUMBER EFFECTIVITY AND/OR COMPONENT VALUE NOT SHOWN, REFER TO LIST OF REPLACEMENT PARTS

Figure 4-12b. Schematic Diagram, 20-Megacycle Preamplifier, Units 4-0036 and ON (Drawing No. D8396402G)

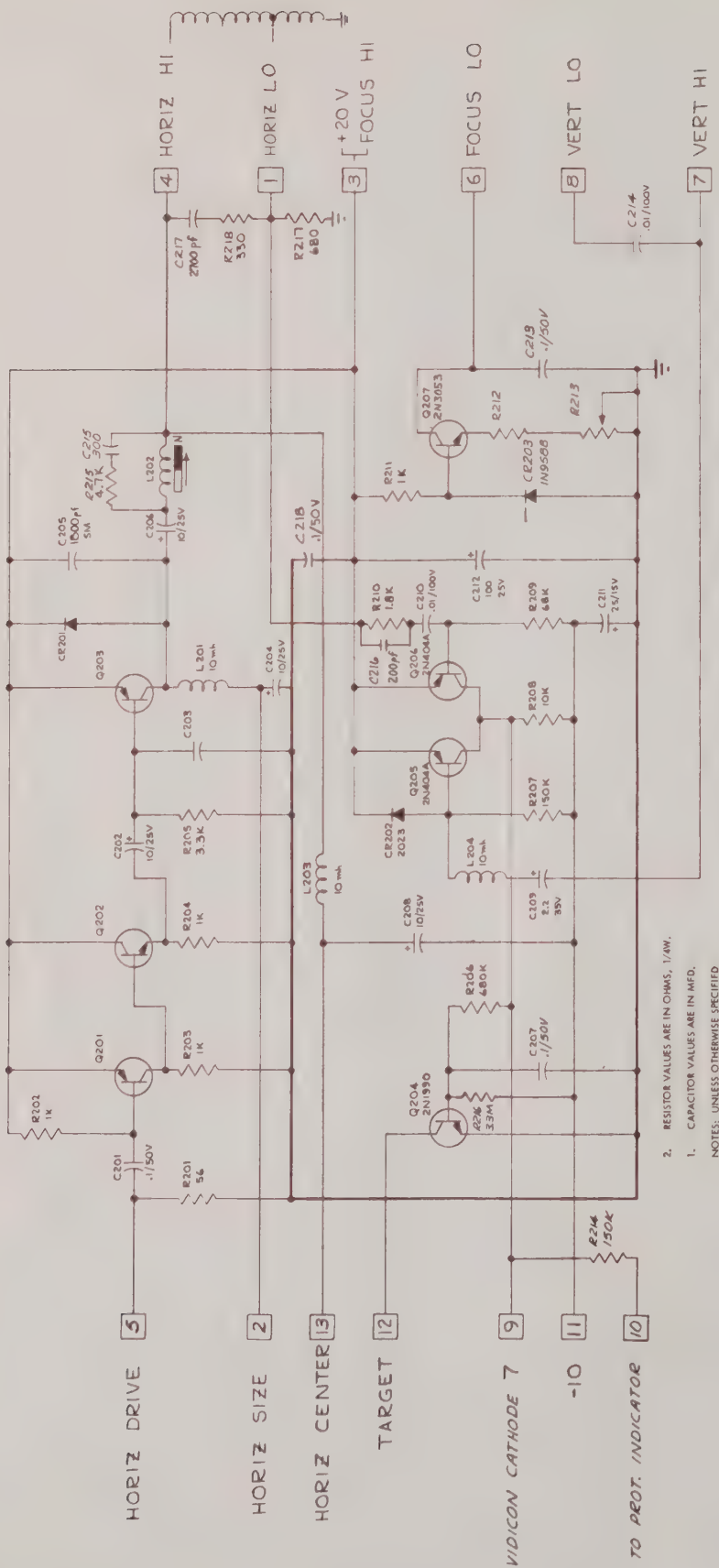


Figure 4-13. Schematic Diagram, Deflection Output Assembly, Units 6-0001 and ON (Drawing No. D8396600G)

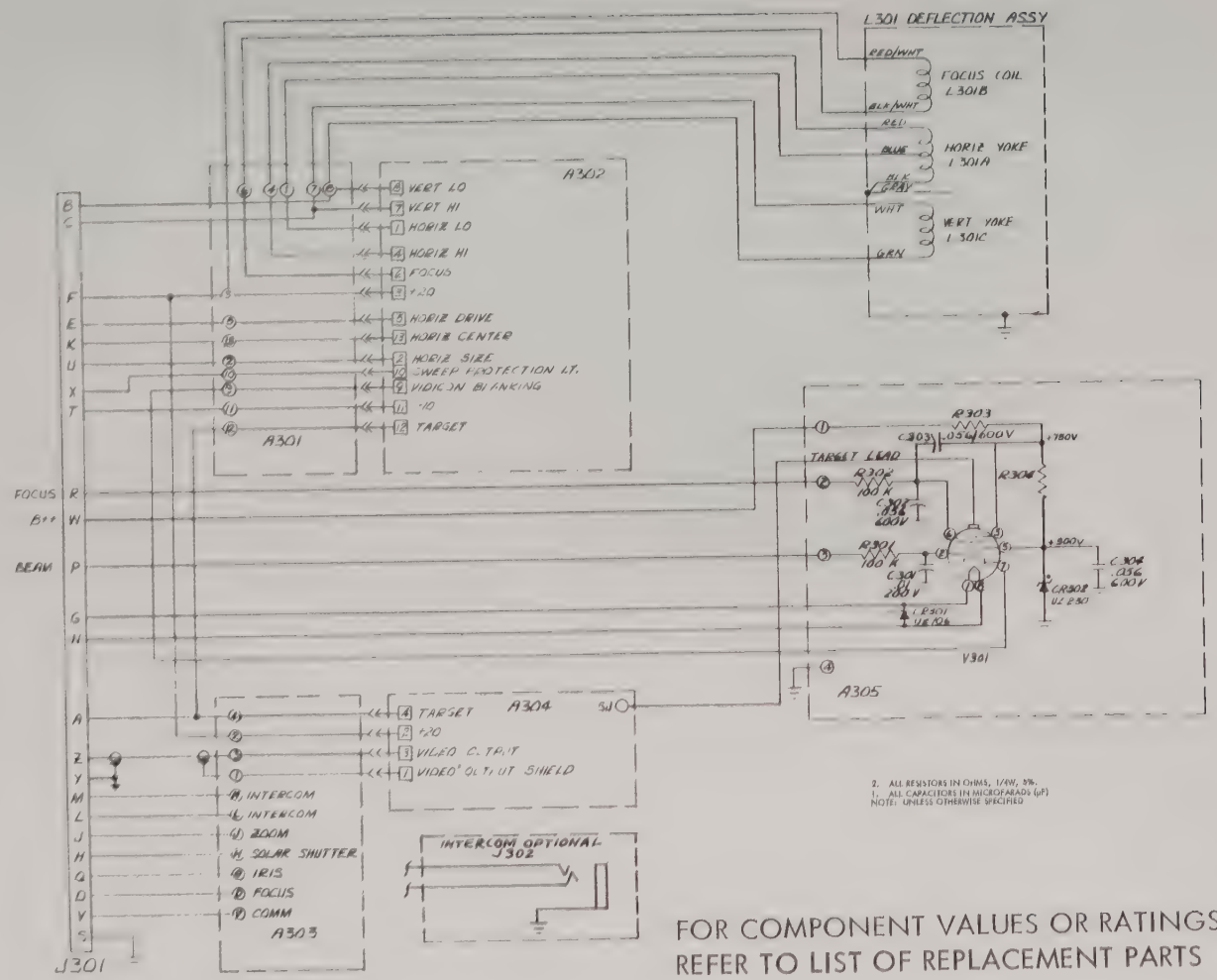


Figure 4-14. Schematic Diagram, Standard 3000 Series Television Camera Less Preamplifier and Deflection Circuitry (Dwg. No. D8396110F)

Table 4-2. List of Replacement Parts, Video Preamplifier Assembly

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
A101	CIRCUIT BOARD ASSEMBLY, VIDEO PREAMP., 10 MC	05157	8396351-001 (8396351-001)
C101	CAPACITOR, MYLAR, .33 μF, 100V	37942	0610109-113 (PVC-1033)
[4]C102	CAPACITOR, MYLAR, .047 μF, 200V	19396	0610117-084 (MR-700-47000 PF-200V)
[3]C102	CAPACITOR, MYLAR, .01 μF, 200V	37942	0610109-201 (PVC-211)
[2]C103	CAPACITOR, ELECTRO PC, 40 μF, 25V	56289	0510093-029 (89D-40 μF)
[3]C104	CAPACITOR, ELECTRO PC, 25 μF, 15V	56289	0510092-022 (89D162)
[1]C105	CAPACITOR, ELECTROLYTIC, PC, 100 μF, 25V	56289	0510093-030 (89D226)
C107	CAPACITOR, TANTALUM, 2.2 μF, 35V	05397	0510135-002 (K2R2P35)
C108	CAPACITOR, SOLID TANTALUM, 2.2 μF, 35V	05397	0510135-002 (K2R2P35)
[1]C109	CAPACITOR, TANTALUM, 25 μF, 15V	05397	0510135-006 (K22P15)
C110	CAPACITOR, VALUE SELECTED IN TEST	-----	04010-- (------)
C111	CAPACITOR, ELECTRO PC, 25 μF, 15V	56289	0510092-022 (89D162)
C112	CAPACITOR, SOLID TANTALUM, 2.2 μF, 35V	05397	0510135-002 (K2R2P35)
C113	CAPACITOR, SOLID TANTALUM, 22 μF, 15V	05397	0510135-006 (K22P15)
C114	CAPACITOR, SOLID TANTALUM, 2.2 μF, 35V	05397	0510135-002 (K2R2P35)
C115	CAPACITOR, SILVER MICA, 2 pF, 500V	02799	1010006-020 (DM15-020M)

Table 4-2. List of Replacement Parts, Video Preamplifier Assembly (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
L101	INDUCTOR, VALUE SELECTED IN TEST	-----	2310029---- (----------)
Q101	TRANSISTOR, TYPE TI415	01295	7210064-001 (TI-415)
Q102	TRANSISTOR, TYPE 2N2654	73445	7210052-001 (2N2654)
Q103	TRANSISTOR, TYPE 2N2654	73445	7210052-001 (2N2654)
Q104	TRANSISTOR, TYPE 2N3053	86684	7210035-028 (2N3053)
R101	RESISTOR, 1/4W, 5%, SELECTED IN TEST	-----	---------- (----------)
R102	RESISTOR, 1/4W, 5%, 560 KILOHM	96906	4045000-564 (RC07GF564)
R103	RESISTOR, 1/4W, 5%, 82 KILOHM	96906	4045000-823 (RC07GF823J)
R104	RESISTOR, 1/4W, 5%, 1 MEGOHM	96906	4045000-105 (RC07GF105J)
R105	RESISTOR, 1/4W, 5%, 680 OHM	96906	4045000-681 (RC07GF681J)
R106	RESISTOR, 1/4W, 5%, 47 OHM	96906	4045000-470 (RC07GF470J)
R107	RESISTOR, 1/4W, 5%, 390 KILOHM	96906	4045000-394 (RC07GF394J)
R108	RESISTOR, 1/4W, 5%, 330 KILOHM	96906	4045000-334 (RC07GF334J)
R109	RESISTOR, 1/4W, 5%, 27 KILOHM	96906	4045000-273 (RC07GF273J)
R110	RESISTOR, 1/4W, 5%, 47 KILOHM	96906	4045000-473 (RC07GF473J)
R111	RESISTOR, 1/4W, 5%, 10 KILOHM	96906	4045000-103 (RC07GF103J)

Table 4-2. List of Replacement Parts, Video Preamplifier Assembly (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
R112	RESISTOR, 1/4W, 5%, 6.8 KILOHM	96906	4045000-682 (RC07GF682J)
R113	RESISTOR, 1/4W, 5%, 39 OHM	96906	4045000-390 (RC07GF390J)
R114	RESISTOR, 1/4W, 5%, 4700 OHM	96906	4045000-472 (RC07GF472J)
R115	RESISTOR, 1/4W, 5%, 4700 OHM	96906	4045000-472 (RC07GF472J)
R116	RESISTOR, 1/4W, 5%, 22 KILOHM	96906	4045000-223 (RC07GF223J)
R117	RESISTOR, 1/4W, 5%, 10 KILOHM	96906	4045000-103 (RC07GF103J)
R118	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
R119	RESISTOR, 1/4W, 5%, 680 OHM	96906	4045000-681 (RC07GF681J)
R120	RESISTOR, 1/2W, 5%, 470 OHM	96906	0310030-471 (RC20GF471J)
R121	RESISTOR, 1/4W, 5%, 22 KILOHM	96906	4045000-223 (RC07GF223J)
R122	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
R123	RESISTOR, 1/4W, 5%, 8.2 KILOHM	96906	4045000-822 (RC07GF822J)
R124	RESISTOR, 1/4W, 5%, 22 KILOHM	96906	4045000-223 (RC07GF223J)
	[1]USED IN PREAMPLIFIERS 3-0001 THROUGH 3-0210 [1]USED IN PREAMPLIFIERS 3-0061 THROUGH 3-0210 (NOT USED PRIOR TO PREAMPLIFIERS 3-0211) [2]USED IN PREAMPLIFIERS 3-0211 AND ON [3]USED IN PREAMPLIFIERS 3-0236 AND ON [4]USED IN PREAMPLIFIERS 3-0001 THROUGH 3-0235		

Table 4-3. List of Replacement Parts, Deflection Output Assembly

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
A202	CIRCUIT BOARD ASSEMBLY, DEFLECTION OUTPUT	05157	8396602-001 (8396602-001)
C201	CAPACITOR, MYLAR 602, .1 μF, 50V	84411	0610090-009 (TYPE 602 .1 μF, 50V)
C202	CAPACITOR, TANTALUM, 10 μF, 25V	05397	0510135-001 (K10P25)
△C203	CAPACITOR, MYLAR, .01 μF, 100V	19396	0610114-026 (MR330-10000 PF-100V)
‡C203	CAPACITOR, MYLAR 608, .047 μF, 100V	84411	0610126-473 (TYPE 608-047 μF, 100V)
C204	CAPACITOR, TANTALUM, 10 μF, 25V	05397	0510135-001 (K10P25)
C205	CAPACITOR, SILVER MICA, 1800 μF, 500V	02799	1010008-182 (DM19-182J)
C206	CAPACITOR, TANTALUM, 10 μF, 25V	05397	0510135-001 (K10P25)
C207	CAPACITOR, MYLAR 602, .1 μF, 50V	84411	0610090-009 (TYPE 602 .1 μF, 50V)
C208	CAPACITOR, TANTALUM, 10 μF, 25V	05397	0510135-001 (K10P25)
C209	CAPACITOR, TANTALUM, 2.2 μF, 35V	05397	0510135-002 (K2R2P35)
C210	CAPACITOR, MYLAR, .01 μF, 100V	19396	0610114-026 (MR330-10000 PF-100V)
[1]C211	CAPACITOR, ELECTRO PC, 25 μF, 15V	56289	0510092-022 (89D162)
[1]C212	CAPACITOR, ELECTRO PC, 100 μF, 25V	56289	0510093-030 (89D226)
C213	CAPACITOR, MYLAR 602, .1 μF, 50V	84411	0610090-009 (TYPE 602 .1 μF, 50V)

Table 4-3. List of Replacement Parts, Deflection Output Assembly (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
C214	CAPACITOR, MYLAR, .01 μF, 100V	19396	0610114-026 (MR330-10000 PF-100V)
C215	CAPACITOR, CERAMIC DISC, 300 pF, 1000V	71590	0401032 (DD-301)
C216	CAPACITOR, SILVER MICA, 200 pF, 500V	02799	1010006-201 (DM15201J)
C217	CAPACITOR, SILVER MICA, 2700 pF, 500V	02799	8-1010008-272 (DM20F272J)
C218	CAPACITOR, MYLAR, .1 μF, 50V	84411	0610090-009 (TYPE 602 .1 μF, 50V)
[3]CR201	DIODE, GERMANIUM, TYPE 1N91	94989	3506751-002 (1N91)
[4]CR201	DIODE, GERMANIUM, TYPE 1N92	80131	3510025-002 (1N92)
CR202	DIODE, GERMANIUM, TYPE 2023	73293	3510050-003 (2023)
CR203	DIODE, ZENER, TYPE 1N958B	80131	3510036-019 (1N958B)
L201	INDUCTOR, 15 μH	80843	2310039-001 (83-105)
L202	COIL, ADJUSTABLE	05157	2310041-001 (2310041-001)
L203	INDUCTOR, 15 μH	80843	2310039-001 (83-105)
L204	COIL, PC, 10 μH	80843	2310037-001 (99-105)
Q201	TRANSISTOR, TYPE GA2046	01295	7210027-003 (2N404/ GA2046)
[3]Q202	TRANSISTOR, TYPE 2N706	80131	7210047-010 (2N706)
[4]Q202	TRANSISTOR, TYPE 2N3646	07263	7210068-001 (2N3646)

Table 4-3. List of Replacement Parts, Deflection Output Assembly (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
△ Q203	TRANSISTOR, TYPE 2N3147	80131	7210033-012 (2N3147)
‡Q203	TRANSISTOR, TYPE 2N3731	86684	7210033-022 (2N3731)
Q204	TRANSISTOR, TYPE 2N1990	07910	7210035-019 (2N1990)
Q205	TRANSISTOR, TYPE 2N404A	80131	7210035-015 (2N404A)
Q206	TRANSISTOR, TYPE 2N404A	80131	7210035-015 (2N404A)
Q207	TRANSISTOR, TYPE 2N3053	86684	7210035-028 (2N3053)
R201	RESISTOR, 1/4W, 5%, 56 OHM	96906	4045000-560 (RC07GF560J)
R202	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
R203	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
R204	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
R205	RESISTOR, 1/4W, 5%, 3300 OHM	96906	4045000-332 (RC07GF332J)
R206	RESISTOR, 1/4W, 5%, 680 KILOHM	96906	4045000-684 (RC07GF684J)
R207	RESISTOR, 1/4W, 5%, 150 KILOHM	96906	4045000-154 (RC07GF154J)
R208	RESISTOR, 1/4W, 5%, 10 KILOHM	96906	4045000-103 (RC07GF103J)
R209	RESISTOR, 1/4W, 5%, 68 KILOHM	96906	4045000-683 (RC07GF683J)
R210	RESISTOR, 1/4W, 5%, 1800 OHM	96906	4045000-182 (RC07GF182J)

Table 4-3. List of Replacement Parts, Deflection Output Assembly (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
R211	RESISTOR, 1/4W, 5%, 1 KILOHM	96906	4045000-102 (RC07GF102J)
[3]R212	RESISTOR, 1W, 5%, 27 OHM	96906	0310031-270 (RC32GF270J)
[4]R212	RESISTOR, 2W, 5%, 30 OHM	56289	5110036-300 (240E3005)
[5]R213	RESISTOR, VAR., PORM., 25W, 10%, 20 OHM	07479	5010074-001 (PC2-20)
[6]R213	RESISTOR, VAR., PORM., 25W, 10%,	07479	5010084-001 (MP2-20)
[3]R213	RESISTOR, VARIABLE, 1W, 20 OHM	75042	5010095-200 (100-20 OHM)
R214	RESISTOR, 1/4W, 5%, 150 KILOHM	96906	4045000-154 (RC07GF154J)
R215	RESISTOR, 1/4W, 5%, 4700 OHM	96906	4045000-472 (RC07GF472J)
R216	RESISTOR, 1/4W, 5%, 3.3 MEGOGM	96906	4045000-335 (RC07GF335J)
R217	RESISTOR, 1/4W, 5%, 680 OHM	96906	4045000-681 (RC07GF681J)
R218	RESISTOR, 1/4W, 5%, 330 OHM	96906	4045000-331 (RC07GF331J)
R219	RESISTOR, 1/4W, 5%, 27 OHM	96906	4045000-270 (RC07GF270J)

[1]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0001 THROUGH 6-0220
[2]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0221 AND ON
[3]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0001 THROUGH 6-0420
[4]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0421 AND ON
[5]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0001 THROUGH 6-0270
[6]USED IN DEFLECTION OUTPUT ASSEMBLIES 6-0271 THROUGH 6-0420
△C203 MUST BE .01 μF WHEN DISCONTINUED TYPE 2N3147 IS USED FOR Q203
‡C203 MUST BE .047 μF WHEN REPLACEMENT TYPE 2N3731 IS USED FOR Q203

Table 4-4. List of Replacement Parts, Electrical Assembly, 3000 Series Cameras

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
A301	CONNECTOR BOARD ASSEMBLY, DEFLECTION OUTPUT	05157	8396603-001 (8396603-001)
A303	CONNECTOR BOARD ASSEMBLY, VIDEO PREAMPLIFIER	05157	8396401-001 (8396401-001)
A305	CIRCUIT BOARD ASSEMBLY, FILTER	05157	8396302-001 (8396302-001)
C301	CAPACITOR, MYLAR, .01 μF, 200V	12406	0610121-103 (ZX2P103K)
C302	CAPACITOR, MYLAR, .056 μF, 600V	12406	0610123-563 (ZX6P563K)
C303	CAPACITOR, MYLAR, .056 μF, 600V	12406	0610123-563 (ZX6P563K)
C304	CAPACITOR, MYLAR, .056 μF, 600V	12406	0610123-563 (ZX6P563K)
CR301	DIODE, ZENER, 6.8V, 5%	13141	3510062-001 (UZ706)
CR302	DIODE, ZENER, 300V, 10%	13141	3510062-003 (UZ230)
J301	CONNECTOR, ELECTRICAL RECEPTACLE	71468	1310126-002 (BFR24-28P-3-A105)
L301	COIL ASSEMBLY, DEFLECTION AND FOCUS	05157	8386114-001 (8386114-001)
R301	RESISTOR, 1/4W, 5%, 100 KILOHM	96906	4045000-104 (RC07GF104J)
R302	RESISTOR, 1/4W, 5%, 100 KILOHM	96906	4045000-104 (RC07GF104J)
R303	RESISTOR, 1/4W, 5%, 47 KILOHM	96906	4045000-473 (RC07GF473J)
[1]R304	RESISTOR, 1/2W, 5%, 330 KILOHM	96906	0310030-334 (RC20GF334J)
R304	RESISTOR, 1W, 5%, 330 KILOHM	96906	0310031-334 (RC32GF334J)

Table 4-4. List of Replacement Parts, Electrical Assembly, 3000 Series Cameras (Contd)

CIRCUIT REF.	DESCRIPTION	MFR.	COHU PART NO. (MFRS. PART NO.)
[1]R305	RESISTOR, 1/2W, 5%, 470 KILOHM	96906	0310030-474 (RC20GF474J)
♀V301	VIDICON, TYPE 8507	06433	7110016 (8507)
	LOCKRING, VIDICON	05157	8372017-001 (8372017-001)
	"O" RING, CAMERA HOUSING SEAL	81349	0310063-249 (MS9021-249)
	WRENCH, SPANNER, ADJUSTABLE HOOK	65814	9710008-001 (474A)
	WRENCH, HEX-SOCKET, "L" HANDLE	05157	9710009-001 (9710009-001)
	WRENCH, HEX-SOCKET, "L" HANDLE, 1/16"	70276	9710010-001 (116116564)
	WRENCH, HEX-SOCKET, "L" HANDLE, 5/64"	70276	9710010-002 (116116564)
	WRENCH, SPANNER, VIDICON LOCKRING AND "C" MOUNTADAPTER	05157	8349052-001 (8349052-001)

[1]USED ONLY IN CAMERA ELECTRICAL ASSEMBLIES 2-0011 THROUGH 2-0360

[2]USED ONLY IN CAMERA ELECTRICAL ASSEMBLIES 2-0361 AND ON

♀VIDICON MUST BE CHOSEN TO MEET SYSTEM REQUIREMENTS. REFER TO VIDICON DATA SHEET AVAILABLE FROM COHU

Section V
ACCESSORIES

5.1. GENERAL

Data sheets for certain accessories are bound in this manual to provide preliminary reference data. Detailed specifications and application information not stated or implied in these data sheets may be obtained from:

Cohu Electronics, Inc., Box 623, San Diego, California 92112, or from the COHU representative in your area.

5.2. SPECIFIC ACCESSORIES

Individual instruction manuals are provided for accessories such as pan-and-tilt units, zoom lenses and iris-and-focus units.

Other accessories are of configurations which do not warrant individual manual coverage. Such accessories are considered adequately documented by the applicable engineering drawing(s) and notes. Such documentation may be incorporated in this accessories section, or may be attached as required.

5.3. SOLENOID SHUTTER

The Solenoid Shutter installed in 3000 series cameras provides vidicon protection from accidental exposure to direct rays of the sun or other source of extremely bright light. The basic installation incorporates a solenoid-operated shutter which is normally open when the camera-system power is applied. If power fails,

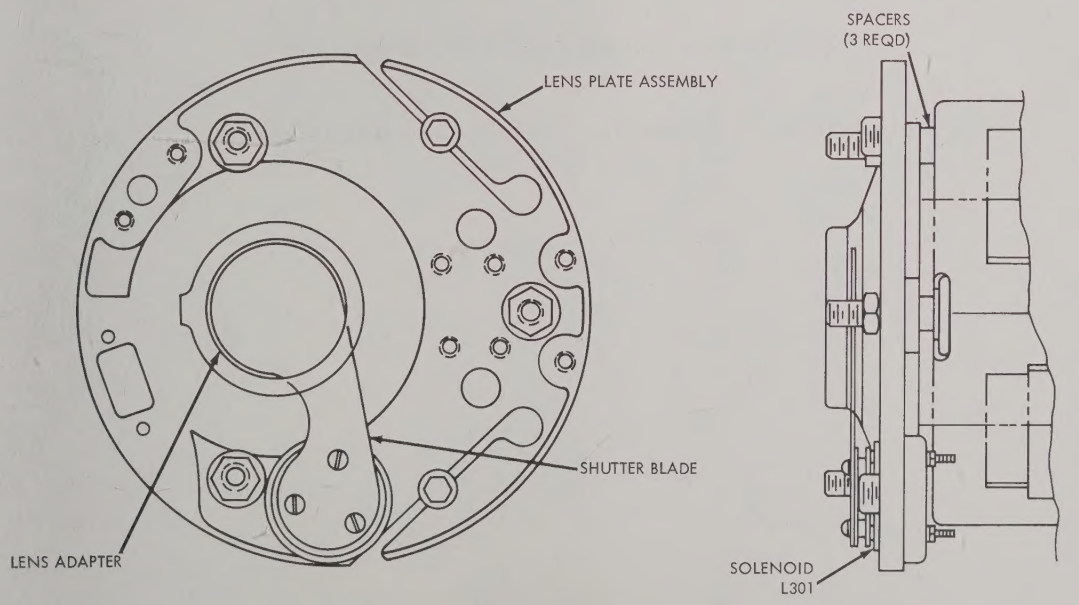


Figure 5-1. Component Locations, Solenoid Shutter Installation

or if the system is shut down, the solenoid is de-energized and the released shutter is positioned between the vidicon face and the camera lens (Figure 5-1). Solenoid connections are shown in the schematic diagram of Figure 5-2.

A switch may be incorporated in the control circuit to permit shutter closure while the system power is on. Photosensitive switches may be used to cause automatic shutter closure at a preset light level.

For details of power and control circuitry refer to the manual for the 3900 series camera controls, Code No. 6X-331(A).

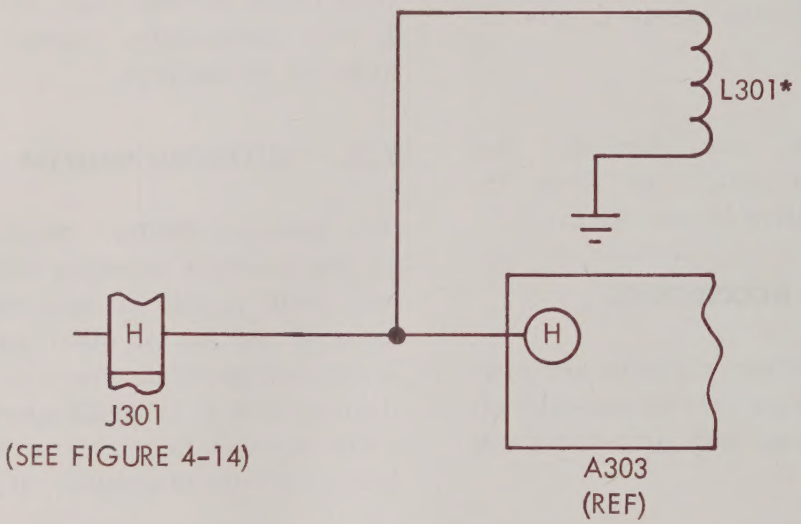


Figure 5-2. Schematic Diagram, Solenoid Connections (See Figure 4-14)

WARRANTY

COHU ELECTRONICS, INC., warrants equipment manufactured to be free from defects of material and workmanship. Any part or parts will be repaired or replaced when proven by COHU examination to have been defective within one year (90 days for batteries, fuses, transistors and tubes) from date of shipment to the original purchaser. All warranty repairs will be performed at the factory or as otherwise authorized by COHU in writing. Transportation charges shall be prepaid by purchaser.

This warranty does not extend to COHU equipment subjected to misuse, accident, neglect or improper application; nor repaired or altered by other than COHU or those authorized by COHU in writing.

This warranty is in lieu of all other warranties express or implied. COHU shall not be liable for collateral or consequential damages.

For customer convenience, service departments are maintained throughout the United States by COHU Field Engineering Representatives.

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